Journal and Proceedings

OF

The Royal Society of Western Australia.

PATRON: HIS MAJESTY THE KING.

Volume III.

1916 - 1917.

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CONTENTS.

Volume III.

LIST OF PLATES AND FIGURES.

LIST OF PLATES AND FIGURES—*continued.*

LIST OF OFFICERS, 1916-1917.

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Members of Council : Prof. W. J. Dakin, Messrs. E. S. Simpson, R. H. B. Downes, G. S. Sutton, and H. McKail.

LIST OF MEMBERS.

30th June, 1917.

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Wood, J. A., State School, Australind, *via* Bunbury.

ASSOCIATE MEMBERS.

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Hardy, G. H., Public Museum, Hobart, Tasmania.
Le Messurier, C. J. R., T. & G. Chambers, Perth.
Lapsley, R., Fire Station, Perth.
Lovegrove, Dr. F. (absent at the War).
Rawson, V. S., Explosives and Analytical Department, Wellington Street, Perth.
Shelton, Miss K., 138 Hamersley Road, Subiaco.
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Steedman, H., Suburban Road, Victoria Park.
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Watson, Miss P., Inchbrayock, South Perth.
Wood, W. E., Existing Lines Branch, W.A.G.R., Perth.

CORRESPONDING MEMBERS.

Hedley, C., F.L.S., Australian Museum, Sydney.

STUDENT MEMBERS.

Montgomery, S. K., 30 Richardson Street, West Perth.

PROCEEDINGS OF THE ROYAL SOCIETY OF WESTERN AUSTRALIA.

August 8th, 1916.—The President, Professor A. D. Ross, in the Chair. Paper on the "Wheat Industry of Western Australia," by Mr. G. L. Sutton, Commissioner for the Wheat Belt. The following exhibits were shown by Professor Dakin:—

(1.) Nest of the Bag-shelter Moth Caterpillar.

(2.) Embryo of Dromicia.

September 12th.—The President, Professor A. D. Ross, in the Chair. Mrs. R. H. B. Downes was elected as an Associate Member, and Dr. Lotz and Mr. Lane-Poole as ordinary members of the Society. A paper was read by Miss Jewell, B.Sc., on "Recent Developments in Motion Photography." The following exhibits were shown:—

(1.) Large number of Peripatus from South-West, by Professor Dakin.

(2.) Meteorite from Mt. Magnet, by Mr. E. S. Simpson, B.Sc., B.Eng.

October 12th.—The President, Professor A. D. Ross, in the Chair. The President referred to the loss sustained by the Society in the death of Mr. Bernard H. Woodward, late Director of the Western Australian Museum. Mrs. Heyworth Watson and Miss Phyllis Watson were elected Associate Members of the Society. Mr. W. J. Hancock, M.Inst. C.E., read a paper on "X-Rays."

October 23rd.—Special meeting to celebrate the Ter-centenary of Dirk Hartog's landing in Western Australia. Professor A. D. Ross in the Chair. A paper on "The Early History of the Discovery of Australia" was read by Mr. Siebenhaar.

November 14th.—The Vice-President, Mr. A. Montgomery, in the Chair. Mr. W. A. Saw was elected an ordinary member, and Mr. A. R. L. Wright as an Associate Member. Paper by Professor Dakin on "Some Biological Problems connected with the War."

Miss Davy exhibited a Wood-boring Moth.

December 12th.—The Vice-President, Mr. W. J. Hancock, was in the Chair. Mrs. Lukin was elected an ordinary member and Miss Cowan as an Associate Member. A paper on "The Work of the Perth Observatory" was read by Mr. H. B. Curlewis.

Mr. E. de C. Clarke exhibited diagrams of Glacial Boulders East of Laverton.

Mr. McKail exhibited some lantern slides and arc appliances made by boys.

March 13th, 1917.—Mr. A. Montgomery, Vice-President, in the Chair. A Paper on "The Theory of Closed Beams" by Mr. R. H. B. Downes, was laid upon the table for private perusal by members interested in the study of Statics. The following exhibits were shown:—

(1.) Head of a Papuan, presented to the W.A. Museum, by Lieut. G. Clifton, A.I.F.
(2.) Centipede with 91 young (in spirits), also some beetles, by Mr. Steedman.
(3.) A Wasp's Nest commandeered by a Solitary Bee, by Mr. W. H. Matthews.
(4.) Samples of a new type of Dune Rock, by Mr. E. S. Simpson.
(5.) Geological Specimens by Mr. A. Montgomery.

April 17th, 1917.—Professor Ross, President, in the Chair. A new Rule, 12A, proposed at previous meeting was carried. Rule 12A:—"From and including the date of adoption of this rule, all members elected at any time during the latter six months of the Financial Year shall pay half the annual subscription appertaining to the class to which each is elected for the then current year."

The following were elected:—H. W. Sanders, B.A.; F. S. Brockman, Surveyor General; and Dr. O'Connor, as ordinary members, and W. E. Wood as an Associate Member. Mr. W. H. Taylor delivered a Paper entitled "Coal Resources Preserved as a Result of Electric Power Supply."

May 8th, 1917.—Professor A. D. Ross, President, in the Chair. R. A. Rolland, James Thompson, B.Eng.; Dr. Trethowan, Cecil Andrews, M.A., and T. G. Sutherland were elected ordinary members of the Society. Mr. W. B. Alexander, M.A., Keeper of Biology in the W.A. Museum, gave an account of the Zoological Discoveries of the First Ten Years of the Swan River Settlement.

The following exhibits were shown:—

(1.) New Varieties of Wheat, by Mr. G. L. Sutton.
(2.) Fossilised Wood from Gingin, by Mr. E. S. Simpson, B.Sc., B.Eng.
(3.) Specimens of Terns, by Mr. W. B. Alexander, M.A.

June 12th, 1917.—The President, Professor A. D. Ross, was in the Chair. The President announced that His Excellency the Governor, Sir William Ellison-Macartney, had consented to become Vice-Patron of the Society in place of the late Governor, Sir Harry Barron. Miss Nesbitt and Mr. H. Bowley were elected ordinary members of the Society. Professor A. D. Ross delivered his Presidential Address on "The State and Science." A vote of thanks was moved by Mr. H. B. Curlewis and seconded by Mr. A. Gibb-Maitland, and carried by the Society.

July 10th, 1917.—Annual Business Meeting and Conversazione. The President, Professor A. D. Ross, was in the Chair. His Excellency the Governor, Sir William Ellison-Macartney, and the Minister for Education, Mr. Colebatch, were the special guests of the evening.

The following members of Council were duly elected unopposed:—

President: Mr. A. Montgomery.
Vice-Presidents: Messrs. G. L. Sutton and W. J. Hancock.
Past President: Professor A. D. Ross.
Treasurer: Mr. F. E. Allum.
Secretary: Mrs. C. M. G. Dakin, B.Sc.
Librarian: Dr. Stoward.

Council: Professor Dakin, Messrs. H. B. Curlewis, C. E. Lane-Poole, A. Gibb-Maitland, and E. S. Simpson.

Copies of the Annual Report and the Statement of the Receipts and Expenditure were handed round to each member and taken as read and adopted.

The following exhibits were on view:—

(1.) Spectroscopes in action, Electrical Apparatus, and Simple forms of Musical Instruments were shown by Professor Ross.
(2.) X-Ray Apparatus and X-Ray Photographs. Mr. W. J. Hancock.
(3.) Electric Vacuum Tubes. Mr. W. J. Hancock and Professor Ross.
(4.) Specimens of Crude Graphite Ores, and a Model Concentration plant of the flotation type was shown in action. Messrs. T. Blatchford and E. S. Simpson.
(5.) Reputed Poison Plants, and certain Parasitic Plants. Dr. Stoward.
(6.) New Varieties of Wheat. Mr. G. L. Sutton.
(7.) Sun-dial of local invention, and other Astronomical Instruments. Mr. H. B. Curlewis.
(8.) Tradesmen's tokens circulated in Australia during latter half of last century, during dearth of subsidiary coins. Mr. A. O. Watkins.
(9.) Animal Parasites and the two newly discovered antiseptics, viz., Flavine and Brilliant Green. Professor Dakin.

At the close of the inspection of exhibits refreshments were served, and the incoming President, Mr. A. Montgomery, was installed and welcomed by the Society.

THE ROYAL SOCIETY OF WESTERN AUSTRALIA.

ANNUAL REPORT—YEAR 1916-1917.

Ladies and Gentlemen,—

Your Council begs to submit the Annual Report for the year ending 30th June, 1917.

During the year His Excellency the Governor, Sir William Ellison-Macartney, has been appointed Vice-Patron of the Society, and the Council welcomes the addition to the Office-Bearers of one who has taken so deep an interest in science and education.

The number of members on the Roll is now 92. Of these seven are honorary members, 64 are ordinary members, 20 are associate members, and one is a student member. Four members of the Society are absent from the State on active service or special work in connection with the war. It is with regret that we have to record the deaths during the past session of two prominent members of the Society—that of Mr. Bernard H. Woodward, one of the founders of the original Natural History and Science Society of Western Australia, and that of Mr. H. P. Woodward, late Government Assistant Geologist.

During the year the President, Professor A. D. Ross visited England to make inquiries on behalf of the Advisory Council on Science and Industry, and brought back information, valuable to the Society, on the relations between Science and Commerce.

The Secretary was absent from Perth during five months of the year, and during that period Mr. R. H. B. Downes undertook the duties of Acting Secretary.

The Council held 13 meetings during the year and the attendance of the members was as follows:—Professor Ross 7, Mr. Montgomery 11, Mr. Hancock 7, Mr. Allum 12, Dr. Stoward 11, Mrs. Dakin 8, Professor Dakin 6, Mr. Downes 11, Mr. Gibb Maitland 4, Mr. McKail 6, Mr. Simpson 11, and Mr. Sutton 7

There have been nine ordinary meetings of the Society during the year and the following papers have either been read or laid on the table:—

1. "The Wheat Industry of Western Australia," by Mr. G. L. Sutton.
2. "Recent Developments in Motion Photography," by Miss F. M. Jewell, B.Sc.
3. "X-Rays," by Mr. W. J. Hancock, M.Inst. C.E.
4. "Biological Problems of the War," by Professor W. J. Dakin, D.Sc.
5. "The Work of the Perth Observatory," by Mr. H. B. Curlewis, B.A.
6. "The Theory of Closed Beams," by Mr. R. H. B. Downes, A.M.Inst. C.E.

7. "Coal Resources Preserved as a Result of Electric Power Supply," by Mr. W. H. Taylor.
8. "The Zoological Discoveries of the First Ten Years of the Swan River Settlement," by Mr. W. B. Alexander, M.A.
9. "The Geological Results of an Expedition to the South Australian Border and some Comparisons between Central and Western Australian Geology suggested thereby," by Mr. H. W. B. Talbot and Mr. E. de C. Clarke.
10. "The State and Science," Presidential Address by Professor A. D. Ross, M.A., D.Sc.

An extraordinary meeting of the Society was held on October 23rd, 1916, to celebrate the Ter-Centenary of the Landing of Dirk Hartog on the Coast of Western Australia. A paper on the subject was read by Mr. W. Siebenhaar.

The usual exchanges of the Society's Journal and Proceedings with the publications of various institutions have been made by the Librarian.

Volume II. of the Journal and Proceedings of the Society is almost complete, and it is hoped to have copies ready for distribution before the end of the month.

(Signed) A. D. ROSS,
President.

C. M. G. DAKIN,
Hon. Secretary.

10th July, 1917.

The following is a statement of the receipts and expenditure of the Royal Society of Western Australia for the year ended the 30th June, 1917:—

Receipts.	£	s.	d.	Expenditure.	£	s.	d.
Subscriptions (including £8 8s. for 1917–18) ...	77	8	6	Printing:—			
Interest on Banking Account	0	8	5	Reprints of papers in Vol. I. of the Journal ...	19	18	3
Sale of Journal	0	5	0	300 maps	1	7	3
Authors' fees for extra reprints of papers in Journal	10	2	8	Fee to Trustees of Museum, for cleaning, caretaking, etc., of Society's room ...	12	0	0
				Petty expenses, including postage, etc. ...	13	4	3
Total of sums received during the year ...	88	4	7	Total of sums spent during the year	46	9	9
Balance in hand at beginning of year—				Balance in hand at end of year—			
At Bank .. £9 4 10				At Bank .. £51 15 0			
In Cash .. 0 19 8				In Cash .. 0 4 0			
	10	4	6		51	19	4
	98	9	1		98	9	1

Note.—Of the balance in hand at the end of the year, the sum of £8 8s. belongs to next year, leaving £43 11s. 4d. as the true balance of the year 1916-17. There is, however, an outstanding account for printing Volume II. of the Journal, amounting to £47 2s. 6d. The cash transactions properly belonging to the year 1916-17 have, therefore, resulted in a deficit of £3 11s. 2d.

(Signed.) F. E. ALLUM,
Hon. Treasurer,
Royal Society of W.A.

The above statement and the accounts and vouchers supporting the same have been duly audited by us and found to be correct.

(Signed) H. B. CURLEWIS,
A. O. WATKINS.

6th July, 1917.

LIST OF DONORS TO THE LIBRARY.

AUSTRALIA—

Geological Survey of Western Australia.
Western Australian Museum and Art Gallery.
Royal Society of South Australia.
Department of Agriculture of Victoria.
Field Naturalists' Club of Victoria.
National Herbarium of Victoria.
National Museum, Melbourne.
Royal Society of Victoria.
Commonwealth Bureau of Census and Statistics, Melbourne.
Department of External Affairs, Melbourne.
Royal Australasian Ornithologists' Union.
Field Naturalists' Club of Tasmania.
Royal Society of Tasmania.
Technological Museum, Sydney.
Botanic Gardens, Sydney.
Royal Society of New South Wales.
Australian Museum, Sydney.
Royal Zoological Society of New South Wales.
Government Bureau of Microbiology, Sydney.
Naturalists' Society of New South Wales.
Public Health Department of New South Wales.
Botanic Gardens, Brisbane.
Royal Society of Queensland.

ASIA—

Botanical Survey of India.
Department of Public Instruction, Assam.

EUROPE—

Royal Botanic Gardens, Kew.
Royal Colonial Institute.
Museum National d'Histoire Naturele, Paris.
Societe Royal de Botanique de Belgique.

AMERICA—

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United States Department of Agriculture.
United States Geological Survey.
Academy of Natural Sciences of Philadelphia.
University of Minnesota.
University of Nebraska.
Field Museum of Natural History, Chicago.
Lloyd Library, Cincinnati.
John Crerar Library.
American Association for International Conciliation, New York.

THE JOURNAL

OF

THE ROYAL SOCIETY

OF

WESTERN AUSTRALIA.

VOL. III.

THE STATE AND SCIENCE.

PRESIDENTIAL ADDRESS

BY

PROFESSOR A. D. ROSS, M.A., D.Sc., F.R.A.S., F.R.S.E.

(Delivered on 12th June, 1917.)

On this, the occasion of my retiring address as President of your Society, I desire to thank the members, and particularly my colleagues on the Council for the support they have given me during my term of office. I am afraid that I have not been able to devote as much time to the Society as I ought to have done, and my recent visit to the homeland necessitated my absence from three of the monthly meetings. I propose, however, to make what amends I can to-night by speaking on matters which, while I have thought much about them in the past, were brought vividly before me during my stay in England.

The Great World War has had a far-reaching effect. Here, even in Australia, where we are as far as we can well be from the zone of warfare, where perhaps the effects of the war are felt less severely than in almost any land in the Empire, we have been aroused from the even tenor of our ways by new difficulties, new problems, and new duties. The war has forced that breach in tradition which gives a chance to a new spirit and new methods. We shall in any case have to rebuild. Our works have been stopped or disorganised, our young men have left their trades and professions to give their services in our nation's army and navy, our educational system has been interrupted by the exigencies occasioned by diminished staffs, scarcity of teaching material, and in some places reduced accommodation. Now, if ever, is the time for us to reorganise the training of the manhood of our nation's workers, if a change is desirable.

Let us look at what need there is for change.

The British were the first to develop mechanical industry and to employ science for practical ends on a commercial scale. At the time of the Napoleonic wars they had obtained an almost complete monopoly of oceanic navigation and of the markets outside Europe. Their financial resources and enterprise had established them as the chief sellers and buyers in every country that had not been leavened with European civilisation, and in all undeveloped regions, the wide world over, the British were either themselves the pioneer workers or they supplied the requisite credit and the means of transport. All this was the work of spontaneous effort. British factories, British shipping firms, British engineers, British bankers and financiers, British emigrants owed little to their Government except protection against armed violence. There was no public system for the encouragement and development of industry and commerce, no public system of instruction in the principles of science. Oxford and Cambridge were the chief homes of learning —small towns far removed in thought and manner as well as in space from the busy world of machinery, shipping, banking, and commerce. The absence of State linkage was accompanied by a lack of union in the working world itself. Every firm stood aloof from every other. Each was jealous of its business connections and of its trade secrets. The basic principle that "union is strength" was daily disregarded.

Educated men, too, still held themselves aloof from industry and commerce, partly because their assistance was not requested, sometimes because offers of assistance were received with distrust and suspicion. In most cases the first founders of great businesses were uneducated men, men who perhaps had acquired their own knowledge of men and things, and who, meeting success through some accidental and, for them, fortunate chance of circumstances, felt no interest in the great expanse of knowledge, explored and unexplored. They had no notion that it contained anything that could be of value to them except here and there a practical detail of which they could see the immediate application. When they did come across a man of science or his works they noticed that he had little thought of practical applications: if he did venture on a practical suggestion he was easily floored on the practical details. The business man did not see that his practical acumen and the researcher's learning could form a valuable combination. Doubtless, there were many notable exceptions, but they were comparatively few.

So long as the British monopoly was maintained, the practical common sense and energy of British manufacturers and men of business sufficed for the immediate needs of industry and commerce, though it is not difficult to see that a little more system, a little more scientific control, a little more collective foresight would

have saved us from many of the social evils which we now labour to remedy. But nearly forty years ago a new phenomenon appeared. A nation, a new nation, entered the field of competition. Up to that time British manufacturers, British merchants, British shippers had at most to face the competition of foreign firms which the British with their superior resources, credit, experience, and connections could easily confront. About 1880 a nation began to organise itself as a nation for industrial and commercial competition.

By the war of 1870 the German people became a nation, the whole of whose resources were at the disposal of the State and its component governments. The German rulers by tradition believed in system, forethought, and authority; the German people by nature and habit were ready to accept authoritative instruction, to obey, and to act upon suggestion. The natural leaders were different from our own in type and in attitude of mind. In Great Britain—outside the class of landowners—the men of power and position were manufacturers, merchants, shipowners, bankers. All these were practical men, who owed little to government or science. In Germany the landowners were powerful. Their military bias inclined them to system, care for detail, and direction from above. They were practical men, full of the new national spirit. They looked to the Government for support: in matters about which they were ignorant they looked for guidance to scientific authority. The historians taught them that a nation should be self-supporting and harmoniously developed in all directions, and that agriculture was the basis of all stable progress. They taught also that, in suitable conditions, the prosperity of industry redounds to the advantage of agriculture. Thus, while industry and commerce were systematically encouraged, agriculture was not allowed to suffer from neglect. The progress of German agriculture has been no less remarkable than that of industry and commerce, and owes no less to science. The commercial and industrial class had been hitherto politically and socially unimportant; their experience was insufficient. The leadership of the nation—outside of official circles—lay with the learned caste, which was numerous, respected, and profoundly convinced of the universal value of science. The higher officials had for the most part passed through the universities, and, if they had learnt anything there, they had learnt respect for knowledge and scientific methods. Therefore, when Germany began to build up from the bottom a great national system of industry, commerce, and credit, she had at her disposal the practical sense of the landowners, the learning of the professors, the power of the Government, and the national enthusiasm of the people. Britain had only one of these elements active. The practical sense and experience of her people were doubtless superior; but such learning as existed was aloof or disregarded; the Gov-

ernment had some regulative power, but no tradition of initiative; business was regarded as a private matter, lying outside national duties and national ambition. Great German firms naturally study to earn a profit; but in their operations the advance of Germany is also a constant aim. We have hitherto ignored the national motive, and although we must despise the aims which urged Germany to thrust her so-called "kultur" on the entire world we must admire the organisation which gave her almost the necessary power, and which is at the present moment enabling her to meet almost single-handed the combined strength of the nations.

With what success the German people have since 1880 pursued their purpose in industry, agriculture, transport, and commerce is too much a matter of common knowledge to require repetition here. In that success the power and forethought and initiative of the German Government were important factors; the alliance between practical men and men of science was also of great value; but the national spirit of united effort in furtherance of German greatness, power, and prosperity was the greatest force of all.

A new national spirit has been aroused in the British nation by the war. Britons in every clime have answered the nation's call in the present crisis. Nothing has done more to stamp out the cry that our race is degenerate than the splendid rally of the overseas dominions round the flag of the homeland. But, if we are to recover and improve our position at the end of the war that national spirit must be maintained. Unless every man and woman comes to know and feel that industry, agriculture, commerce, shipping and credit are national concerns, and that education is a potent means for the promotion of these objects among others, we shall assuredly fail in the great effort of national recuperation. In plain words, our great firms will not make money, wages will fall, and wage-earners will be out of work.

Germany has attempted to spread the belief in neutral countries that we entered the war in the hope that we might crush German trade and industry by force since we had failed to do it by peaceful competition. If such an ambition had animated the mind of anyone it would have been futile and self-destructive. British industry and commerce must suffer by the war to the full extent of our diminished resources, our lost manhood, and our wasted years. Any diminution of German competition will be more than compensated by the loss of German markets, by the impoverishment of most of our customers in every part of the world, and by the advantage gained by our commercial rivals while our efforts are suspended during the war. When travelling out from England to Australia less than three months ago I was struck by the fact that, while in England one heard of the efforts to be made to

capture German trade *after* the war, the Japanese have already captured a good deal of this trade and are likely to keep it.

In the task of making good our losses in material, in men, in time, and in business connections, we must waste no time and neglect no source of strength. We must approach that task as a national task of vital importance to our well-being and our self-respect, if not our very existence, as a nation.

In this work of reconstruction three lines of action must be taken up.

First of all we must bring the practical man and the man of science to work together for the common end, to value each other's qualities. We have enough science at the present time to make such co-operation ten times more productive for the future than it is now. But our scientific men, we are told, are not sufficiently practical; our practical men ignore the scientific method and the potentialities of science. We need that men of science shall be also practical, and that men of practice shall be also scientific.

Secondly, we must improve the existing means of scientific and technological instruction, and encourage scientific research especially in the direction of technology.

Thirdly, we must improve the education of the workman—agricultural as well as industrial—so that he will be better fitted to understand the scientific principles and methods on which modern industry must be based; and we must secure from all classes of the community—by scholarships and otherwise—a steady supply of able, well-trained, and zealous students to fit themselves for the conduct of scientific business and for the improvement of its methods.

I have mentioned three lines of action, but let me emphasise the fact that these, even if distinct, must be contemporaneous and concurrent. Simultaneous advance is required in each direction. We shall have a heavy burden to bear. The burden may probably take the form of financial debt, but that very burden of debt may prove, as it often has proved in history, a powerful stimulus to exertion and innovation. We shall have to practise economy, but to stint education, study, or research will be the most disastrous of all possible forms of economy. "It may be possible to do more in education with equivalent means than has been done in the past, but it is certain that unless we are prepared to spend upon education more effort, more thought, and even more money, after the war than we did before, we shall not regain or retain our place among the nations."

I am glad to say that the Home Government has been keenly alive to the importance of the position. It has taken up each of the three lines I previously indicated, and something is being effected in each direction. Let me indicate briefly what is being done.

First of all with regard to the interaction of theory and practice. It has been recognised that there is a need to foster both pure science and applied science. The need for applied science is perhaps at first sight the more important. The great Universities and the Technological and Technical Schools can supply a large number of trained workers in various grades. They can turn out more provided they obtain an improved supply; and that supply will increase as the demand for their finished product—men trained in applied science—becomes more extensive and better known. The need for pure science may appear less important, but technological work depends upon pure science and upon the researches of pure science. Without a high training in pure science and without the results of research in pure science, technological advance, if not impossible, would be seriously retarded. Huxley said that what people called applied science was nothing but the application of pure science to particular classes of problems. Properly speaking, this is so; there are not two different kinds of science. At the same time the boundaries of science are so wide that one can almost differentiate two classes of workers within it. There is first the man who investigates the basic principles and, aided by observation and experiment, logically deduces what he may describe as truths of science. Then there is the man who discusses these truths in their relations to practical applications of science in engineering, electricity, medicine, etc. It might be thought that the former man was divorced from the practical problems of daily life. But experience has shown that all the great practical advances in science, such *e.g.* as the inventions of electric dynamos, electric telegraphs, and submarine and wireless telegraphy, would have been greatly delayed, or more probably altogether lost, but for the pure science worker in electricity. For success in scientific work there is one condition which is supreme and which ought to be before the eyes of the investigator from the outset. It is that of in nowise permitting oneself to forget that it is one's duty to follow out the line of research which lies before one irrespective of the apparent utility or immediate availability of the results in the world of practical affairs, while at the same time taking care not to become so absorbed in abstract speculation as to be blind to the rich world of concrete truth and practical application. There is in short a continual interaction between theory and practice which in no way interferes with the devotion of the scientific man to pure research or that of the engineer in the main to practical affairs.

Nevertheless, the average business man is impressed with the importance of quick returns. If science can help him to overcome the difficulties that cross his path from day to day he welcomes her. He wants a handy servant, not so much a partner with ideas of her own. And it is here that the difficulty arises. As was pointed out in the Final Report of the Royal Commission on Uni-

versity Education in London "the difficulties that present themselves to manufacturers or merchants seldom afford an indication of the true nature of the problems to be solved. They are generally secondary in their nature, and a direct attack on them is likely to be as empirical as the symptomatic treatment of disease." Thus such quick-result inquiries as the manufacturer is induced to make himself are very likely to be fruitless and to reduce his enthusiasm for Science still further. She finds, too, few suitors in our industries, for she is a mistress who reserves her favours for a complete and single-hearted devotion.

The Home Government in order to overcome this initial difficulty have accordingly done much to bring together the heads of great industrial and commercial concerns and existing scientific bodies such as the learned societies. In July, 1915, a Committee of the Privy Council for Scientific and Industrial Research and an Advisory Council were established and commenced their work forthwith. They at once got into conference with leading societies such as the Royal Societies, the Chemical Society, the Institute of Chemistry, the Royal Institute of British Architects, the Faraday Society, the Federation of Master Printers, the Society of Chemical Industry. These conferences proved of extreme value and indicated how the best talent available in science could be directed upon urgent practical problems. Since then various standing committees have been appointed, committees on metallurgy, engineering, mining, etc., formed half of representatives of the existing societies concerned and half of business people appointed by the Advisory Council. The Council hope in this way, through the representatives of the Societies, to have the whole societies helping in the work.

As another example of what is being done in this way I may mention that early in the war there was a grave danger from the possible exhaustion of the supply of chemical glass necessary for the testing of materials and products. The Institute of Chemistry formed a special Glass Research Committee under the late Professor Meldola, and so enabled Professor Herbert Jackson to indicate the detailed process of manufacturing a number of special glasses, which were rapidly produced by progressive firms. The Advisory Council is now assisting this important joint action of business firms and professional scientists. Similar cases have arisen in connection with pottery manufacture, the silk industry, and other important trades.

Before leaving this subject I would like to say that it will involve further Government action. Let me illustrate by an example. For many years there has been in existence in Perth, Scotland, a firm of ink makers known as Monerieff Bros. Their factory was made as complete and self-contained as was possible, and

so before the outbreak of the war they made their own small glass bottles for the retail trade in ink. These bottles were naturally made of a very inferior kind of glass—in fact, the cheapest available material, that being amply good enough for the purpose. After the outbreak of war when Professor Meldola's Committee sought the co-operation of the glass manufacturers, this progressive firm of Moncrieff Bros. entered with enthusiasm into the work. Such has been their assiduity that, as I can now say after a detailed inspection of their works and examination of their products, they are now turning out a glass in no way inferior to the best chemical glasses of the Jena firms. Their success has been recognised, and they have obtained a contract to give their whole time to supplying special chemical glasses for the Government and controlled munition works. But you will see the danger of their position. They are completely engaged in work which will practically terminate with the war and they are unable now to build up a trade which will be enduring. I am glad, however, to know from a conversation which I had with Lord Balfour of Burleigh—the Chairman of the Royal Commission on Trade after the War—that there is every probability of the Government taking such action as will place a heavy embargo on any goods imported into the country after the war, and which might have been made by such enterprising firms as the one I have mentioned.

We turn now to the second line of action, viz., the encouragement of research and the training of technical scientists. This, too, has been carefully taken up by the Home Government. Of course, at the present time when the universities and higher colleges are practically denuded of their senior students, it is impossible to do much in the way of training more men for research. The action which has been taken so far has been rather in the direction of assisting present researches, which appear from their nature to be of special value in their bearing on industry and commerce. The Advisory Council in recommending, and the Committee of the Privy Council in granting funds in aid of such researches, have openly stated that they are thus helping applied science and for the time being neglecting pure science. They have, however, stated that this is merely an emergency action, and they realise that continued and substantial help must very soon be given in pure science or else applied science will thereby cease to be fruitful. Grants have been made in aid of existing researches in connection with laboratory and optical glasses, corrosion of non-ferrous metals, composition of alloys, steel testing, etc., and other grants have been made to initiate researches on porcelain, the disintegrating action of sea-water, the metallurgy of tin and tungsten, the de-gumming of silk, etc.

These grants-in-aid are, however, only a temporary scheme. It is realised that in the course of a few years it will be necessary

to get in action a far-reaching scheme to increase the number and size of the institutions for training investigators and for the prosecution of research, and to make available scholarships and grants for those who can devote their time to advancing science.

It is recognised that with this interaction of theory and practice three types of laboratory will be required. There will be the ordinary routine or "works" laboratory for controlling the quality of raw materials, finished products and processes. This will of necessity be situated in the works but must be under a trained investigator. Next comes the "industrial" or "efficiency" laboratory, situated probably in some technological or technical institution, where one works out improvements in products and processes tending to lessen cost of production and to introduce new products on the market. Then comes the true "Research Laboratory" to formulate the underlying theory. It implies a large, elaborately equipped and heavily staffed laboratory, largely engaged on work which cannot have an important bearing on any manufacture or bring any financial return for periods of five or ten years at least. It is, however, all important. Without such a laboratory, "Abbe's work on Lenses, Abbe's and Schott's work on Glasses, or the establishment by a firm in England of the three alkaloids that go to make up ergot and the sympathetising of two of them could never have been accomplished."

Already such a system of laboratories is in action in munition work. It is, of course, impossible for me to describe in detail what they are doing, but their success will be evident when I mention as an example that in the course of the last two years they have resulted in a reduction in the time required for the preparation of T.N.T. from 70 to 7 hours, thereby securing a ten-fold larger output of the explosive, apart altogether from that due to the increased size and number of the factories.

Turn now to the third line of action, that of improving education generally, and in particular of raising the standard of education of the worker. This is a sphere in which little has been definitely effected since the outbreak of the war—not because its supreme importance has been overlooked, but because of the very magnitude of the changes required and of the necessity for planning them with the utmost care. The matter is receiving wide attention. All the educational institutions of the home country are concentrating their attention upon it, and special committees and commissions have been appointed to undertake special investigations. It was one of the pleasant features of my visit to England to find educationalists who had long differed in their opinions as regards methods, if not also aims, meeting in harmony and each doing his utmost to evolve a satisfactory and efficient scheme.

There is little likelihood of any extensive change in the system of elementary education—that is education up to the age of 12

or 14 years. At this stage the public education is compulsory and gratuitous and uniform. Above the age of 14 matters are different. Education is no longer compulsory and many pupils leave school. Those who remain may either continue in the public and private secondary schools, or go to Trade Schools and to Junior Technical and Commercial Schools. Except in these latter schools, education between the ages of 14 and 16 is usually general and unspecialised. Long, I hope, may it continue so. If there has been one factor which has brought Scottish education its world-wide fame, it has been its insistence on a wide and substantial general training. I know that in Scotland the school boards have recognised that in nine cases out of ten the best teachers for their schools have been ordinary graduates with a training in seven or eight distinct subjects, and not honours graduates, with a meteoric career through several stages of one or two subjects and attendance on other three or four additional courses to fill up a curriculum. Don't imagine that I am decrying the specialist. I am the last person who would decry the efficient specialist, but I shall always look with mistrust on the man who has so specialised in his training as to cut out other important branches of knowledge. What faith would one put in a scientific adviser, whose education had been so lop-sided, that he had failed to obtain that training in literature and history which is necessary for the comprehension of those social, political, and moral problems, which become more insistent as time goes on, and which are as much needed for the general purposes of the nation as science itself? While members of scientific societies must ever use their influence to see that science is taught, as it should be taught, in every secondary school, I trust they will never use their influence to have science taught to an extent which must produce neglect in teaching other equally important branches of human knowledge.

One frequently hears commercial men saying that lads who come to their offices after a school course in which the curriculum has been on the commercial side are no better than others. I do not marvel at that. What does surprise me is that those boys, leaving school at 14 or 15, are not much worse than they are. To attempt to specialise before that age appears to me to be a deliberate outrage on young lads. The sooner business men realise the necessity and advantages of a sound general education up to 14 or 15, followed by slight specialisation up to 16 or 17, the sooner will they find their business worries reduced. We need the compulsory age of elementary general education raised to 15 or 16. We need to emphasise the uselessness of too early specialisation, just as we need to emphasise the enormous advantages of *some* specialisation once the boy has a good foundation of general knowledge, has reached years of discernment when he is able to realise that his special training is going to help him in his life work,

and when he has made up his mind as to the nature of that work and so finds his specialised course a congenial study.

In England there is a general consensus of opinion that the age for compulsory education should be raised above 14. The difficulties, financial and otherwise, are enormous; but it is felt that these must soon be faced. I am afraid that it may be a few years before the raising of the compulsory age to 16 can be effected, but it is only a matter of time. Meanwhile something is being done by the granting of scholarships, and by the medium of continuation schools, to lessen the number of unfortunate lads who leave their active education on or before attaining their fourteenth birthday.

A consultative committee of the Board of Education on Scholarships for Higher Education has recommended an additional annual expenditure of about a third of a million pounds on scholarships for higher education and for training in research. Two conditions were regarded by the Advisory Council as essential for the success of their work. The first was a largely increased supply of men who are competent to undertake research; the second was cordial co-operation among men of science, men of business, working men, professional and scientific societies, universities and technical colleges, local authorities, and Government departments. To secure the required number of researchers radical changes are necessary in education. A heavy responsibility rests with Boards of Education and all the great educational institutions to carry out these reforms with the aid of legislature. Co-operation between all concerned is no less essential; for if strife between capital and labour continues after the war, then our national welfare will be seriously imperilled. The proposals to raise the compulsory age of day-school attendance, the development of continuation and secondary schools, and the provision of numerous and adequate scholarships will do much to secure the ends aimed at. Let us hope that public opinion will do everything to aid and nothing to hinder these much-to-be-desired reforms.

I mentioned the desirability of a full and broad general education, and the undesirability of a too early specialisation. The Joint Matriculation Board of the Universities of Manchester, Liverpool, Leeds, and Sheffield are taking the matter up and endeavouring to so rearrange the Matriculation test as to further these ends. They are also considering the possibility of modifying the matriculation requirements in the case of students who have been attending Works Schools, and who, having attained an age of 22 to 25 years, develop a capacity to benefit by university study. Surely it is possible to devise a special test for these students which, without sending them back to schoolboy lessons, would ensure that they had the preliminary knowledge sufficient for university purposes. I may also add that the Joint Board of the Scottish Universities have

already introduced some reforms tending to make the Matriculation test an examination more on general knowledge, and less on that narrow and shallower knowledge which results from early specialisation in the schools.

So far I have spoken of what has been done in the homeland. Let me now recall briefly the position in Australia. I shall not go into any details, for I suppose you will be as well acquainted as I with the situation; but, in outlining it, I shall have the opportunity of indicating directions in which I think advance might be made.

The points at issue may be grouped under the following heads: (1) the co-operation of the Government and educational institutions with business and commercial men and with associations and societies, (2) research, (3) education.

Australia has followed the lead of the Home Government in appointing an Advisory Council of Science and Industry. The scheme has not yet run sufficiently long for us to gauge accurately the advantages which will accrue. Still, a good start has been made. As in England, the first work has been to foster industrial investigations—research in applied science. Sub-committees have set to work on problems connected with agriculture, with conservation of our timber, with the utilisation of by-products in industrial processes, and so on. I am hopeful that although as yet only small grants have been placed at the disposal of the Council, these may soon be increased, and extended to application to fundamental researches in pure science as well as in applied science. The Council have collected information regarding the positions of the Universities, colleges, and other scientific institutions as regards facilities for research, and, it is to be hoped, that some effort will be made to utilise to the full the personnel and the equipment of these institutions. Is it too much to hope that even ways and means may be found by the Advisory Council to increase the ability of universities and colleges to carry out research, by securing for them further help from the Governments, from industrial concerns which would be directly benefited, and from private persons who have the means to do their country a valuable service in helping on work essential to its well-being?

There is one point which I trust will not be forgotten as a consequence of the appointment of an Advisory Council by the Federal Government, and that is that the scientific societies often can give, and are anxious to give, assistance to both the Federal and State Governments. The scientific societies of this State, for example, have not had the advantage of societies in the homeland of appointing a representative or representatives to Government committees formed to investigate scientific matters. Fortunately, we, as a Royal Society, happen to have certain of our members associated with the W.A. State committee of the Advisory Council. These members, however, are there in their private or business

capacities, and not as representatives of this Society. That, I think, is unfortunate. If we had even one person who was associated with the Advisory Council as representing our Society, we should be kept in touch with what was going on by reports from our representative. In that way the whole body of members would be alive to the work, and surely from time to time some of our members would be able to make useful suggestions and transmit them to the Council through our representative, perhaps after general discussion at our Society. Only by keeping every scientific person in touch wtih the work in hand can we be sure that no stone is left unturned in our efforts to assist our State and nation. Our State Government has recognised our usefulness in the past by grants to our Society. These were highly appreciated, and resulted in papers being published which were valuable contributions to science, and which, but for the timely aid of our Government, might have been lost through want of circulation in the scientific world. We recognise that the Government has heavy financial burdens at the present time. We feel, however, the necessity for the publication of our original papers and investigations; we feel that our output has increased in quality as it has in quantity; we have doubled our membership subscription during the past two years or so to help our publication fund; and, may I say, we look forward to the Government continuing to give us that small grant in aid for which I am convinced they have in the past received good value and can now receive still better.

But it is very easy to say others should take notice of us. It is perhaps more difficult for us to enter upon that action which shall make it clearly obvious to everyone that we deserve to have notice taken of us and to command that notice. Are there not opportunities when we could have acted as scientific advisors, and we let the opportunity pass, and it has been seized by others? Let me give an example.

Early in the war it was found that our nation was lacking in aerial fighting machines. The necessity, however, of explaining to the people of Australia that they might make good this shortage fell to the Overseas Club in London and its committees. The scientific societies failed to rise to the occasion.

And now what is the position to-day? It is evident that our aerial supremacy in the war will result in a tremendous development of aerial navigation in the subsequent peace. Already schemes have been laid for linking up the homeland and India by aerial routes. In connection with the scheme suggestions have been made of running branch services on to Australia. It is looking ahead, but must we not always look ahead? Ten years may see the Indian aerial service in active operation, and before the Australian continuation of that service is added we are certain to have considerable State and Interstate aerial communication. There is perhaps

no country in a better position to take advantage of aerial navigation than Australia. Aerial communication is most efficient and economical where the intervening distances are great and the traffic comparatively light and irregular in amount. There is no great capital outlay such as one has in laying down railways. But, for an aerial service to be efficient, it must have suitable stations at the important towns, and that is where the urgent need of action comes in. Recognising the advent of aerial services in the not far distant future, we ought now to provide reserved areas close to our important towns for landing grounds. Suitable landing places are essential, but they are not easily obtained. Let us secure them when we may, otherwise the future efficiency of aerial services will be seriously impaired. Is not this a matter which might well merit our Society approaching the Government? When in England I found from conversation with Major-General Arbuthnot and others closely associated with aerial development that active steps were being taken over almost the whole world to obtain these landing station reserves, and to make other provisions for aircraft work. Are we going to take action in the matter, or do we prefer some London society to take action for us?

I have mentioned this as one example, but many might be given. Let us try actively to show our value, and to obtain our Government's recognition of it.

With regard to co-operation between educational institutions and business men, the situation at present is better and the outlook is bright. Take the position at our own University. In the Faculty of Engineering—that Faculty which comes most closely into touch with industry and commerce—the members of the teaching staff have, since the outset, been assisted in their administrative and educational work by men prominent in engineering and industry. The arrangements have perhaps been hampered by the amount of small detail which had to come before the Faculty, but I trust that the proposals now being made will result in the formation of a stronger advisory board in Engineering, containing representatives of every section of engineering, and with time to devote itself to the discussion of the great problems of engineering education and engineering work. The Public Examinations Board has afforded similar assistance in Arts and has helped very materially to make our State educational system an organic whole from the elementary school to the University.

As regards research, I have already made some general remarks in speaking of the work of the Advisory Council. Let me now, however, say at the outset that the position of research in Western Australia is far from ideal. Some time ago the Committee of the Privy Council for Scientific and Industrial Research in England had the sum of £40,000 placed at its disposal for the current year: (1) for instituting specific researches, (2) for establishing or

developing special institutions or departments of existing institutions for the scientific study of problems affecting particular industries and trades, and (3) for the establishment and award of research studentships and fellowships. More recently the sum of £1,000,000 was voted for scientific and Industrial Research to be spent during the next five years, this amount to be in addition to all the present numerous grants and endowments for research. Australia has had a noble example set before her! But I realise the difficulties of the situation here. We are a young State, hampered financially as every young and rapidly developing State must be. It is very difficult for us to maintain a position abreast of long-established countries. Yet, is it fair to our rising generation that they should be deprived of the facilities which obtain elsewhere? Is it fair to expect our scientific men to keep young in their professions, fired with enthusiasm and filled with knowledge, if they have neither opportunities of advancing their science nor of meeting with their fellow-workers in other lands? It appears to me to be a case, not so much of "Can we afford it?" as "Can we afford to do without it?" Is it in the long run a saving to curtail the educational and scientific staffs of our institutions, so that from sheer over-pressure of work they have little or no time for original research? I consider that the gain would be immediate if our scientific men could be relieved of some of their heavy routine work and were given opportunity to do more for their sciences. I have often thought that the scientific men in our public service would be of much greater value to the State if they had more opportunity of keeping in touch with the advance in other lands. Would it not, for example, be financially advantageous to the State to give those men more frequent and longer long-service leave, so that they would have the opportunity of visiting the home country and looking into the advances that are continually being made there. If they reported on the results of the observations they made on such occasions and on the information they gathered, I am certain our State would receive better value for the money it had thus expended in holiday-salaries, than it has often received for much larger sums spent on local commissions and inquiries. I feel sure that the policy has not been tried, merely because the non-scientific person cannot realise how terribly the scientist in Australia is shut off from the world, and how he must inevitably stagnate if he is not given opportunities of freshening himself once again. The true scientist's education never ends: he must ever advance with the growth of human knowledge.

Time permits me to speak only very briefly on the subject of education in Western Australia. Our elementary educational system has the same disadvantage as the English system in allowing boys to leave school just at that age when it is most essential that they should be kept under discipline and when their education

could make the most rapid strides. The matter seems even more urgent here than in England, for the educational influences at work on a youth after leaving school are less in a young colony than in a fully developed country. The raising of the school age is a great necessity, and the sooner it can be raised to 16, the sooner shall we raise the standard of knowledge and character in our State.

Secondary and technical education have made rapid strides in recent years, and perhaps the greatest difficulty in the way of further advance is the scarcity of teachers. For efficient higher education we require well-informed and well-trained teachers, and to attract the requisite supply of teachers we must make the profession sufficiently attractive. There are too many teachers who have to work both in the daytime and also in the evening, for the work to be vigorous and thorough.

Our State has free education from the kindergarten school to the University—a most laudable thing in itself. Whether it is the ideal arrangement is another matter. The ideal is not to give every person equal opportunities, but to give opportunities according to abilities. It is more harmful to give higher education to one who is unfitted for it, than to keep it out of reach of one who can benefit from it. In the latter case, only the individual immediately concerned is wasted; in the former case, the individual not only fails to benefit by his instruction, but he puts a clog on the working of the class and keeps his fellow-students back. We value a man by his work; we must value a student by his ability. If we have the funds to give everyone full educational training, there is perhaps no harm in free education; but, if we are limited in funds, the attempt to give higher instruction to the unfit may curtail the further instruction which we might give to the fit. Scholarships in number and of sufficient value put higher education within the reach of all, and, if rightly awarded, debar no one from the highest education who is fitted for it.

Lastly let me say that I hope more attention will be paid to the teaching of science in our W.A. secondary schools. I know that teachers find our school curriculum heavy, but is it right that anyone's education should entirely omit some knowledge of what is a great vital force in this the twentieth century? The great truths of physics and of biology lie at the root of our very existence and of our every work. Can we ignore them in the school? Must we not at least lay the foundation upon which the pupil can build up a fuller knowledge of scientific truths and scientific method? Only if we do so can we hope to train up good and useful citizens. Our State then would have, not merely scholars, but men; men of whom she might be proud. Then well is thee and happy shalt thou be; happy in gifts, happy in gratitude, happy in production, happy in service, happy in conscious utility and fruitfulness.

A PAPER READ BEFORE THE ROYAL SOCIETY OF WESTERN AUSTRALIA ON 12th OCTOBER, 1916.

X-RAYS.

(By William J. Hancock, M.Inst.C.E., M.I.E.E.,
Hon. Lieut. A.A.M.C.)

1. Early in the year 1896, just over 20 years ago, a sensational announcement appeared in the newspapers that a "new light" had been discovered, by means of which photographs could be taken through the human body. When the details were published, it was found that this description was not quite correct, but nevertheless it showed that Professor Rontgen, of Wurtzburg, Bavaria, had made a discovery of great importance and which subsequently proved to be of great assistance to the physician and surgeon, besides leading, somewhat indirectly, to the discovery of Radio-activity, and Radium itself, by Madame Curie, about two years later.

Before discussing Professor Rontgen's discovery, it might be well if we briefly review the previous work in this field of research, up to the end of 1895.

2. We are all, I think, familiar with the appearance of the electric discharge through the air, and the noisy and wiry appearance of the spark between the terminals of an induction coil.

3. If instead of the discharge taking place through the air at ordinary atmospheric pressure, we gradually reduce the pressure, a new phenomenon begins to appear.

Let us take a glass tube closed at the ends, and an electrode fused into the glass, at the opposite extremities, and connect the tube to a vacuum pump. It will be noticed that as the pressure is reduced, the disruptive sparking changes to a steady purple or violet glow, which fills the tube. And as the exhaustion is continued the colour of the electric discharge becomes paler and striae or coloured bands begin to appear and then bands appear to oscillate in synchronism with the interruptions of the induction coil. The appearance of the glow and the colour depend on the extent of the exhaustion and the residual gases, as well as the composition of the glass. The well known Geissler tubes, in their great variety of beautiful forms, give examples of electric discharge at medium vacuum.

4. If the tube contains air, as the pressure is reduced by the vacuum pump, the colour of the electric discharge changes from purple or violet to carmine, to salmon pink, and lastly, to pale

white, colours which are observed in the Aurora display—unfortunate rarely seen in this latitude. It is reasonable to assume that the colours of the Aurora correspond to certain pressures, and an estimate may be made of the height of the Aurora display.

The discharge through other gases exhibits various colours, for instance, through hydrogen, blue; nitrogen, orange yellow; carbon dioxide, greenish blue.

5. Up to this point, we have been considering the discharge through tubes, at what we call medium pressures. Other experimentalists, of whom Sir William Crookes was the most prominent, carried out experiments with tubes exhausted to a very much higher degree, and a new and strange phenomenon was observed.

Instead of the continuous illumination, alternate dark and coloured bands or striae filled the tube between the two electrodes. The positive pole or anode appeared surrounded by a purple glow, and from the negative electrode, or Cathode, a luminous beam extended in straight lines to the further end of the tube, and striking the inner walls of the tube produced fluorescence on the glass.

The Cathode stream was found to consist of flying particles of matter, shot from the Cathode in straight lines at high velocity, and can be deflected by a magnet. In these respects, they differ from ordinary light, or ultra-violet rays, which are undulating waves of vibration of varying wave length.

6. "Radiant matter" was the name originally given by Crookes to those flying particles, but later they have been identified as Electrons. Sir J. J. Thompson has calculated their speed at 124 miles per second.

7. The deflection of the Cathode stream by a magnet is clearly shown in a tube designed by Sir William Crookes, in which the stream of particles is projected from the Cathode, through a narrow slit to the end of the tube, and if a magnet is brought near the tube, the stream is attracted or repelled, according to whether the South or North Pole of the magnet is nearer to the tube.

8. At the enormous velocity at which the flying particles are shot off from the Cathode, it is not surprising, when these flying particles collide with an object, they set the molecules of the object vibrating, and if these vibrations are wit' in the range of the light vibrations—fluorescence is produced.

9. The effect of this bombardment and production of fluorescence is beautifully shown in a pear-shaped tube, designed by Crookes in which a hinged Maltese Cross of aluminium is fitted, so that the Cross acts as a shield to intercept the stream. (Fig. 1.) If I turn on the current, you will notice that the part of the glass unprotected by the cross becomes brilliantly fluorescent, while the portion that is shielded appeared as a faintly luminous shadow

of the Maltese Cross, showing that the aluminium had not entirely stopped the Cathode stream. Now, if without stopping the current I tilt the cross down, the shadow becomes more brilliant than the surrounding portion, thus demonstrating that the glass becomes fatigued, as a result of the Cathode bombardment. This tube is also interesting, as it was a tube of similar design which Professor Rontgen used in his experiments.

10. The colour of fluorescence depends mainly on the composition of the glass; a pale blue fluorescence is produced by lead; reddish-yellow by lithium, while soda or potash glass exhibits a yellow green fluorescence, and substances such as shells, marble, and precious stones, become brilliantly fluorescent under the bombardment of the Cathode stream.

11. The conversion of electrical energy of the Cathode stream at its high velocity into heat energy and mechanical work can be shown within the vacuum tube—such as a target becoming white hot, and miniature windmills and paddle wheels rotate at high speed under the impact of the Cathode stream.

12. It has been found that the heat produced is proportional to the charge of rushing electrons, and, therefore, proportionate to the current, and not to the square of the current, as in the passage of electricity through a solid conductor, and it is interesting to note that the energy appears to flow from the negative towards the positive pole of the electric current, or in the reverse direction assumed in general practice, and which was originally assigned by Volta as the direction of flow, but Volta had not, I presume, considered hydrogen to be an electro-positive metal.

13. Sir William Crookes found that the stream of particles would pass through certain substances more freely than through others. Aluminium appeared to be more transparent than platinum or copper, and this property was shown to vary with the density of the material. This led Professor Lenard to attempt to obtain the Cathode stream outside the vacuum tube and designed a tube in which a small opening at one end was closed by very thin aluminium foil. (Fig. 2.) By these means, Lenard was able to obtain a faint bluish diffused glow to about two inches from the aluminium window, and to produce fluorescence in certain substances and to affect photographic plates if brought very close to the window, but instead of the straight beam which is characteristic of the Cathode stream, only the faint diffused glow was observed, and it was evident that it was not the Cathode stream that had emerged, it was a new phenomenon, to which I will refer later.

14. We have now reviewed but briefly some of the main experiments, and what was known of a newly discovered form of matter, up to the end of 1895. It would be impossible in one evening to go into details, or even to examine, step by step, the progress

in this field of research, but Lenard's aluminium window experiments and Crookes' pear-shaped tube are especially interesting in view of Professor Röntgen's discovery.

15. In discussing the experiment up to this date, we have no mention of the generation of Rays outside the tube, excepting perhaps Lenard's experiment; it was therefore startling that in the autumn of 1895 Professor Rontgen, of the University of Wurtzburg, should have discovered, almost accidentally, the rays which now bear his name.

16. During the course of some research in connection with radiations beyond the visible spectrum, or what might be called invisible light, Professor Rontgen used a pear-shaped glass vacuum tube similar to Sir W. Crookes' Maltese Cross tube, and in a long and exhaustive paper read before the Physical Society of Wurtzburg, in December, 1895, described how he used the tube and discovered the new radiations.

The tube was enclosed in black cardboard envelope so as to cut off any illumination from the tube itself, and when the electric discharge was sent through the tube in a completely darkened room, he was greatly surprised that a paper screen coated with barium-platino-cyanide lying on the table a few feet away fluoresced brilliantly, and as the black cardboard covering over the tube precluded any possibility of effect being due to ultra-violet or invisible light, it was obvious that the radiation came from the vacuum tube itself, and Rontgen found that objects placed between the tube and fluorescent screen cast shadows on the screen, and in this way he was able to trace back these new radiations to their source, which proved to be the area where the Cathode stream strikes the glass wall of the vacuum tube. (Fig. 3.)

17. Further investigation proved that whenever the Cathode stream impacts on matter, X-rays are produced, and here was the startling feature of these new radiations—that they had the extraordinary ability to penetrate substances opaque to light.

As to why these new rays have been called X-rays, I will quote from a note to his paper. "For brevity's sake I should like to use the expression rays, and to distinguish them from other rays I will call them X-rays." In this paper he describes various experiments, and discusses their property of penetration, fluorescence, chemical action, effect on the magnetic field, and other scientific data; and I will quote again from his paper the only remark he made which alluded to the one fact that perhaps, in the public mind, eclipsed all other scientific aspects of his paper. It is as follows: "If the hand is held between the discharge tube and the screen, the dark shadows of the bones are visible within the slightly darker shadow of the hands." From perhaps a scientific point of view, he had but added flesh and bones to the list of materials more or less transparent to the new rays; but when it became known that the rays

could pass through the hand and show clearly the bones, the rays were so to speak taken out of the Physical Laboratory and used without loss of time by the physician and surgeon, who realised the immense importance of the new rays in their work.

18. One might now ask how it was that with the many brilliant experimenters at work exploring this field of research the X-rays should have been discovered in an accidental manner. I think there are two reasons: First that the phenomenon was not anticipated, and no doubt many vacuum tubes (as proved afterwards) gave out X-rays without these radiations being recognised, and we now see how close Crookes and Lenard were to the discovery; indeed, the bluish glow at Lenard's window were X-rays, but too small in quantity to assert their startling ability. But perhaps the immediate discovery was due to the fact that Crookes and other workers were using lead glass, whilst Rontgen used a tube made apparently identical with Crookes' tube but, probably unknown to Rontgen, made of glass free from lead, and it was not until after Rontgen accidentally saw his fluorescent screen lit up, that it was realised that X-rays were not emitted from tubes made of lead glass (known as English glass), while with similar tubes made of glass free of lead (such as Bohemian glass), X-rays were produced freely. To illustrate this interesting point, I have a tube of which the body is made of lead-glass, while one end is made of lead-free glass, and you will notice when I turn on the current the bluish fluorescence of the body portion and the apple-green colour of the end of the tube; the former emits no X-rays or very little, while the apple-green end emits X-rays in abundance.

19. In the original X-ray tube the Cathode consisted of a flat disc at one end with the anode on one side and about the middle of the tube; this form, however, gave unsatisfactory results, the X-rays shadows appearing blurred. A great improvement in the design of the tube was made by Professor Herbert Jackson, of King's College. In this form, now universally used, the Cathode is concave and the Cathode stream is focussed on the anode or what is now called the Anti-Cathode or Target, and which consists of a plate or disc of dense metal placed at an angle of about 45 degrees to the Cathode. The Cathode stream, striking the anti-cathode, is deflected at right angles to the side of the tube, and from its glass surface X-rays are given off. The generally accepted theory is that in the impact of the Cathode stream, carrying electrons at very high velocity against the glass walls of the tube, the energy of motion of the flying particles is transformed into a type of vibrations to which Rontgen gave the name X-rays, somewhat as bullets or projectiles driven at high speed against armour plate transform their energy into vibrations of light, heat, and sound.

20. The general form of X-rays tube has been little altered since Prof. Jackson's original design; aluminium is usually used

at the Cathode, while platinum, tungsten, and other metals have been used for the target or anti-cathode. The original anode has been re-introduced and placed somewhat behind the anti-cathode, as it is found to steady the stream and assist it in reducing the ill-effects of reverse current from the induction coil. When the tube is new it gives a beautiful apple-green fluorescence, and in this condition the tube is called "soft"; but after working for some time the Cathode stream finds greater difficulty in passing through the vacuous space and the emission of the X-rays becomes reduced, and higher electrical pressure is required to generate the rays. After operating the tube for some time the glass gradually assumes a purple tinge and becomes darkened, this effect being probably due to volatilisation of the electrodes and disposition of material on the inner walls of the glass. To provide a means of adjusting the resistance of the tube several arrangements have been devised. One form consists of a small alternate discharge tube with an electrode of mica or asbestos, and communicating with the large bulb; by passing current through this attachment small quantities of residual gas are given off, which lowers the vacuum and resistance of the tube. (Fig. 4.) Another form consists of a fine Palladium tube about an inch long, closed at one end, the open end being fused into the X-ray bulb. On heating the closed end of the tube with a spirit lamp air is admitted through the walls of the Palladium tube, as this metal becomes porous at red-heat. Another mode of improving the working of a "hard" tube is to heat the tube in an oven; and it is also found that several months' rest will often bring back a tube to its normal condition, though none of these devices are quite satisfactory, and ultimately the tube becomes unworkable.

21. The X-ray tube is the most important and at the same time is the most inefficient and uncertain part of an X-ray installation.

The tube acts as a transformer, that is, it transforms the electric energy passing through the tube, as the Cathode stream, into X-rays, but by far the greater amount of the energy is converted into heat and other re-actions, and scarcely one part in a thousand of electric energy is transformed into X-rays.

The amount of energy a modern tube can stand is remarkable—for a short time as much as two kilowatts of electricity, or at the rate of 2½ horse power, can be concentrated on the focal spot (a spot about 1/16th inch in diameter), but no tube, excepting perhaps the new Coolidge, can stand this concentrated bombardment for long. Indeed the aggregate effective life of an ordinary heavy type X-ray tube is about 10 hours.

22. Recently a new tube has been designed by Dr. W. Coolidge which marks an important advance in Radiography. The novelty lies in the Cathode, which consists of a small flat spiral of tungsten wire placed in the centre of a small cylinder of molyb-

denum, the latter assisting in focussing the Cathode stream. The ends of the tungsten connecting the terminals to a battery, the tungsten spiral can be raised to a white heat. The anti-cathode or target consists of a heavy piece of wrought tungsten attached to a rod of molybdenum. (Fig. 5.)

On passing a high tension current through a Coolidge tube the output of X-rays is many times greater than from the ordinary tube of the heaviest pattern. The intensity of the X-rays can be controlled by varying the temperature of the Cathode spiral, and the penetration of the X-rays depends, as in the ordinary tube, on the potential difference between the electrodes.

Owing to the very high vacuum, about 1,000 times that of the ordinary tube, no discharge takes place unless the Cathode spiral is heated to a white heat. The tube is also remarkable, that when it is in operation it exhibits no fluorescence, so that its appearance affords no indication of X-ray activity as in the ordinary tube with its brilliant green fluorescence.

23. The X-rays differ from ordinary light in many respects. They are invisible to the eye, but can penetrate substances opaque to light, and have the property of forming a path of conduction of electricity, and this effect is shown by placing a charged electroscope in the neighbourhood of the X-rays tube, and when I turn on the current to the tube you will notice that the leaves of the charged electroscope at once collapse, showing that the insulation of the air has broken down and a path of conduction has been formed by the X-rays; this effect is known as Ionisation, and good insulators such as paraffin, gutta-percha, india rubber, practically cease to be insulators under the X-ray beam.

24. The property of the rays to cause fluorescence in certain substances, such as Barium Platino-Cyanide, and to affect the Photographic Plates is made use of in examination of injuries to the body, or in searching for foreign bodies. in the following manner:—

The portion of the body to be examined is placed between the X-ray tube and the screen or photographic plate, thus the rays in passing through the body are intercepted to a greater extent by metallic substances and the bones, and least by the flesh, thus the shadow of the bones or foreign body appears darker than the flesh on the screen. (Fig. 6.) The movement of joints can be seen, or the beating of the heart followed, and as wood and bandages are transparent to the rays, a broken bone can be examined through the clothes, splints or bandages, or the canvas stretcher, which is in some cases of great advantage to the unfortunate patient.

25. As the X-ray examination is but the observation and study of shadows of varying density caused by the bones and tissues or foreign bodies if present, most of the internal organs of the body cannot be distinguished from other tissues owing to their general

similar density and overlapping of other organs and surrounding muscles.

The denser structure of the heart can be easily seen in the less opaque thorax, and by administering bismuth compounds the whole of the alimentary canal and stomach can be distinguished as in silhouette shadow, thus affording valuable information to the physician.

26. As the shadow on the screen or plate shows everything on the same plane, it is not possible to estimate the depth of, say, a bullet, as compared to the adjoining bones, and it is of great importance to the surgeon to know the depth of a foreign body from the surface; various methods have therefore been devised to locate the foreign body; they are all founded on the principal of triangulation, and I will describe and illustrate with the actual apparatus I have used in the Perth Hospital for some years, and now at the No. 8 Australian Military Hospital at Fremantle, for the location of bullets and shrapnel in our returned soldiers. (Figs. 7 and 8.)

I will first describe the methods of localisation by the photographic plate and cross-thread measurement, and secondly by the fluorescent screen.

27. By the first method, let us take a simple example. Say a bullet in the chest. The patient lies on the table and the photographic plate enclosed in a light tight paper envelope is placed below him, the X-ray tube being vertically above. An exposure is made, the tube is then moved along the table, say 10 centimeters, and a second exposure made; the height of the tube above the patient and above the plate is measured for each exposure, and when the plate is developed two images of the bullet are seen, although the plate is blurred by being exposed twice (so long as the images of the bullet can be clearly seen this is all that is necessary), and by simple calculation the depth of the bullet can be found.

By means of cross threads to represent the rays and the double image on the plate, the depth of the bullet can be found, as follows: the plate after development is placed on a table above which is supported a bar with two sliders and adjusted so that each slider is in a position corresponding to the position occupied by the centre of the target for each exposure, and from each slider a thread is stretched to each image or shadow of the bullet on the plate, and as the stretched threads represent the rays, the point where they cross represents the position of the bullet, and the distance from the front or back of the patient can be at once measured. Scale chart and tables are generally used instead of the cross thread method.

28. To measure the depth of a bullet by the fluorescent screen method, the patient lies on the table, the X-ray tube is placed below and the fluorescent screen above the patient. The screen is supported close above the patient in an adjustable support and the

tube and screen so adjusted that the rays pass vertically through the bullet and project the shadow on the screen. As the vertical distance between the target of the tube and screen is fixed and known, it is obvious that if the tube is moved horizontally it will cause the shadow of the bullet to move in the opposite direction on the screen, and the distance through which the shadow is moved on the screen, relative to the distance moved by the tube, is a measure of the depth of the bullet.

Both these methods give satisfactory results, but the former has the advantage of being a record, and of great use for comparison of subsequent examinations.

29. The X-rays are found to possess beneficial results in cases of some skin and other diseases. Unfortunately very serious and painful damage can be caused by improper or prolonged exposure to the rays, so that great care has to be used so as to avoid damage to healthy tissues; and ill effects frequently do not appear for some time after excessive exposure.

30. The ability of X-rays to pass through opaque objects such as wood, leather, or canvas is made use of for inspection of boxes and packages for Customs and other purposes and also for inspection of manufactured articles when it is undesirable or impossible to make an ordinary examination without disturbing or damaging the article; and to illustrate the value of X-rays examination I will refer to two cases I was consulted about some time ago.

Some years ago a certain make of time fuse for firing explosives in the mines was reported to be uncertain as to its rate of burning. I examined by X-rays and fluorescent screen the fuse to detect possible irregularities in the filling of the powder. I also took some skiagrams showing the powder in the fuse, and by special arrangement I was able to observe on the screen the burning of the powder inside the fuse.

The other instance occurred in reference to an alleged electric "Water Finder" in which the movement of a magnetised needle was supposed to indicate the presence of water underground. A well finished brass-bound mahogany case, carefully sealed, enclosed the mysterious appliance, but an X-ray examination revealed its interior arrangements. The skiagrams I took with 30-second exposure gave excellent detail information which it would be otherwise impossible to obtain without breaking the seals and opening the box. (Fig. 9.)

31. The electric current required for the X-ray tube is of high voltage, as produced by an induction coil or in large installation as in the Perth Public Hospital by means of a rotary converter, and step-up oil transformer, with special means for rectifying the current from the transformer so that instead of the usual sine wave type of alternations, which would be detrimental to the X-ray tube, a pulsating uni-directional current is produced. The voltage

may be estimated by the distance through which the electric discharge will take place between points in air at ordinary pressure; approximately as follows:—

Spark gap between points.	Voltage.
1 inch	30,000
2 inches	50,000
4 inches	80,000
8 inches	130,000
12 inches	190,000
16 inches	230,000

While the voltage for the X-ray tube is high, the current required is small, and is measured in milliamperes, 10 to 20 milliamperes is frequently used; 50 milliamperes or 1/500th of an ampere being a very heavy current for a tube.

The penetration of the X-rays through a body depends on the velocity of the electrons striking the anti-cathode; this effect depends on the difference of potential between the Cathode and the anti-cathode, and explains why high-power apparatus and heavily constructed tubes are necessary to obtain satisfactory results through the thicker portions of the human body, such as the abdominal and kidney regions. With modern high-power apparatus skiagrams of the trunk can be taken in the fraction of a second.

32. That the X-rays are electro-magnetic waves of extremely short wave length doubtless explains their property of great penetration and also the difficulty of refraction and reflection. Sir J. J. Thompson, Professor Bragg, and others have determined their wave length, and from these measurements ordinary light waves are about 400 to 500 times longer than X-rays. On the other hand, electric waves used in wireless telegraphy are many million times longer.

In the attached table I have shown a list of wave lengths of electric waves from the longest generated (as in radio-telegraphy) to the shortest, so far identified as the X-rays, and its companion the Gamma ray.

You will notice great gaps between the wireless telegraph rays and those of light, and between the latter and the X and Gamma rays. What are the properties and effects of these, at present unknown, rays will be a matter for research by the student of science.

33. It would be impossible to discuss in a short paper the various theories in connection with the Cathode stream or the fly electrons, or the generation of X-rays, or as to some recent investigations as to the deflection of X-rays by certain crystals; but I feel sure that you will agree with me that this is but another instance, and a startling one, of the high order and the immense value to humanity, to industry, and to the State of the research work carried out in the scientific laboratories. In Western Australia the field of research, especially in chemistry and biology, is wide, and the gateways are but narrow at present.

How often does the visitor to the laboratory ask the question, "What is the use of this experiment? or that apparatus?" and one might well reply, "What is the use of knowledge?"

34.—ELECTRO-MAGNETIC WAVES.

Table showing ranges of Electro-magnetic Waves so far identified.

	Wave length.		Frequency per second.
	Metres.	Miles, approx.	
Longest Electric Wave generated	15,000	9	200,000
Trans-Atlantic Signals ...	7,000	4	4,300,000
Paris Time Signal	2,000	1¼	1,500,000
Wireless, Navy	1,800	1	1,660,000
Do. Merchant Marine ...	600	⅓	5,000,000
Do. Private	250	...	12,000,000
	Millimetres.		
Infra Red { Longest ...	·3		1 million million
Infra Red { Shortest ...	·0007		428 ,, ,,
Red Light	·00075		462 ,, ,,
Orange Light	·00060		500 ,, ,,
Yellow Light	·00057		520 ,, ,,
Green Light	·00050		600 ,, ,,
Blue Light	·00047		638 ,, ,,
Indigo Light	·00045		666 ,, ,,
Violet Light	·00042		713 ,, ,,
Ultra Violet { Longest ...	·00036		833 ,, ,,
Ultra Violet { Shortest ...	·00006		5,000 ,, ,,
X-Ray ... ... {	·0000012		250,000 ,, ,,
X-Ray ... ... {	·00000014		2,142,000 ,, ,,
Gamma Rays ... ... {	·000000017		17,640,000 ,, ,,
Gamma Rays ... ... {	·000000007		42,850,000 ,, ,,

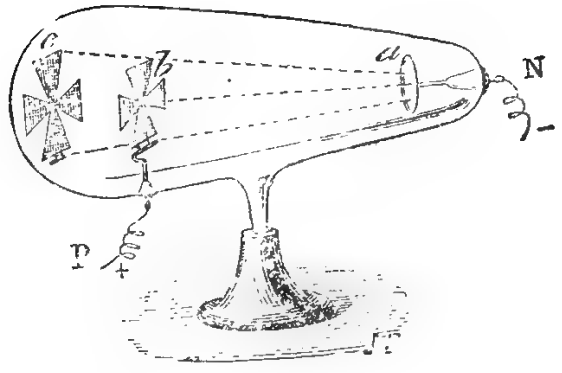


Fig. 1.—Sir W. Crookes' vacuum tube showing cross which can be tilted.

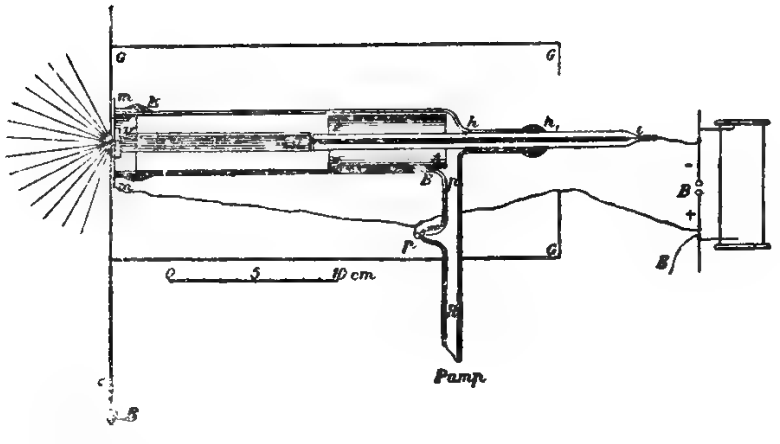


Fig. 2.—Prof. Lenard's vacuum tube with aluminium window at one end.

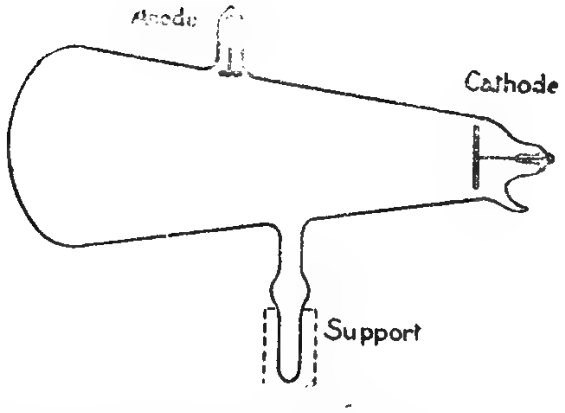


Fig. 3.—Prof. Rontgen's original type of vacuum tube with which he discovered X-rays.

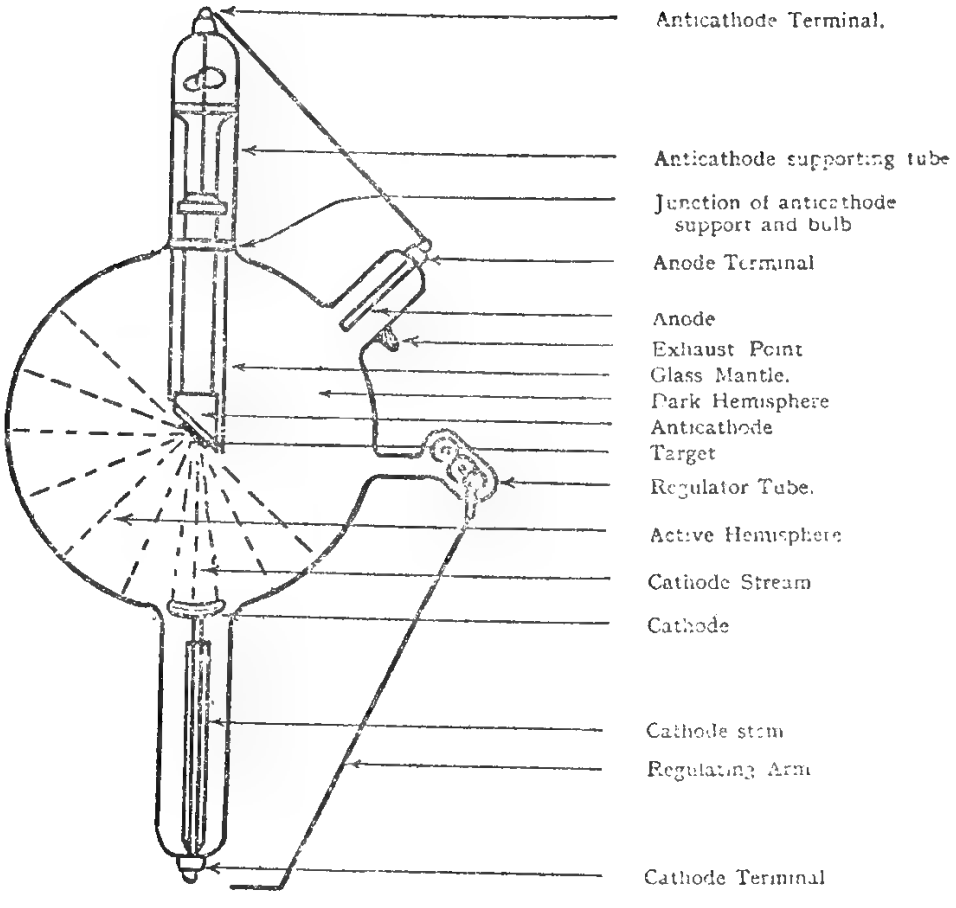
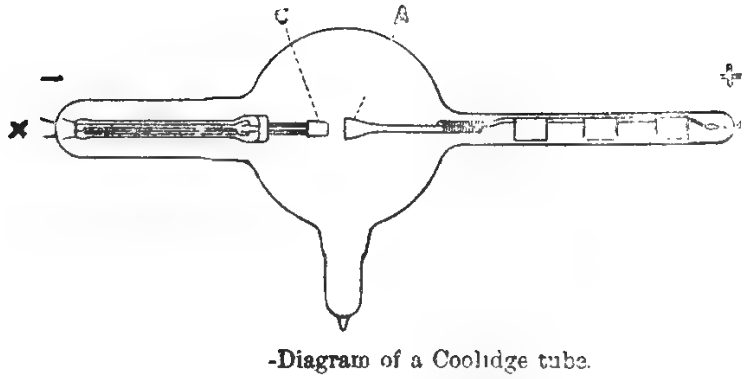


Fig. 4.—A modern X-day tube.



-Diagram of a Coolidge tube.

A, Anti-cathode.
C, Cathode
+, Positive terminal.
−, Negative terminal.
K, Connections to heating-circuit.

Fig. 5.—Coolidge X-ray tube.

Fig. 6.—Skiagram of Hand.

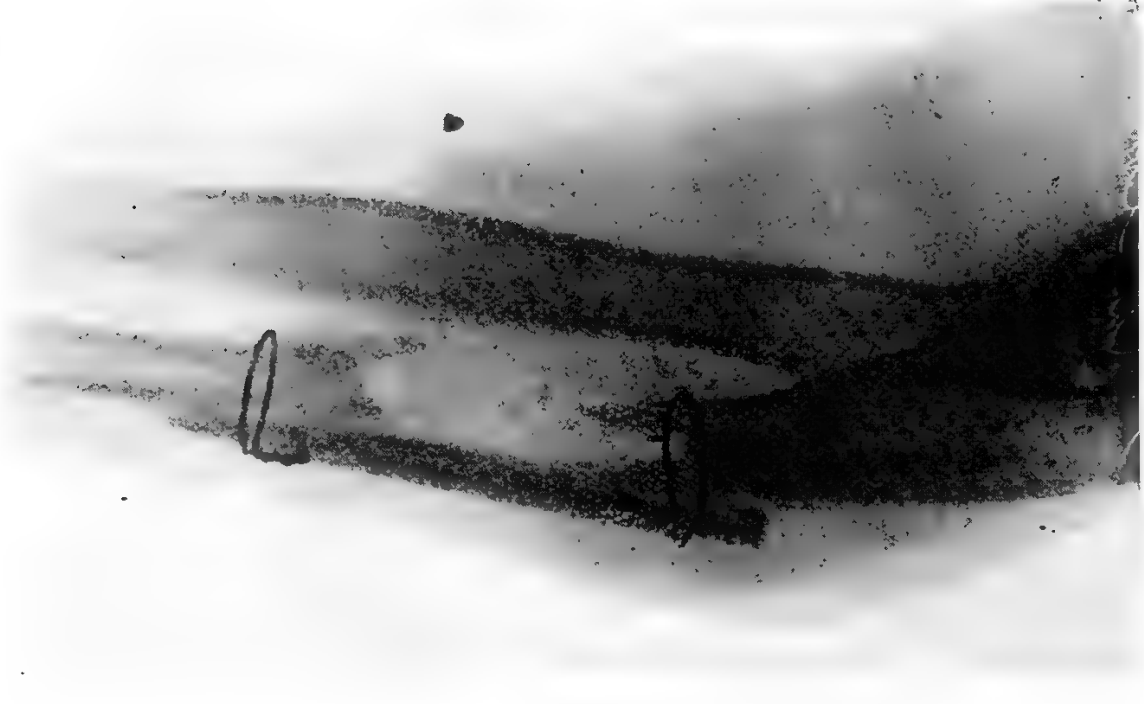


Fig. 7.—Skiagram of Forearm showing grafting of piece of shin bone replacing part of ulna shot away.

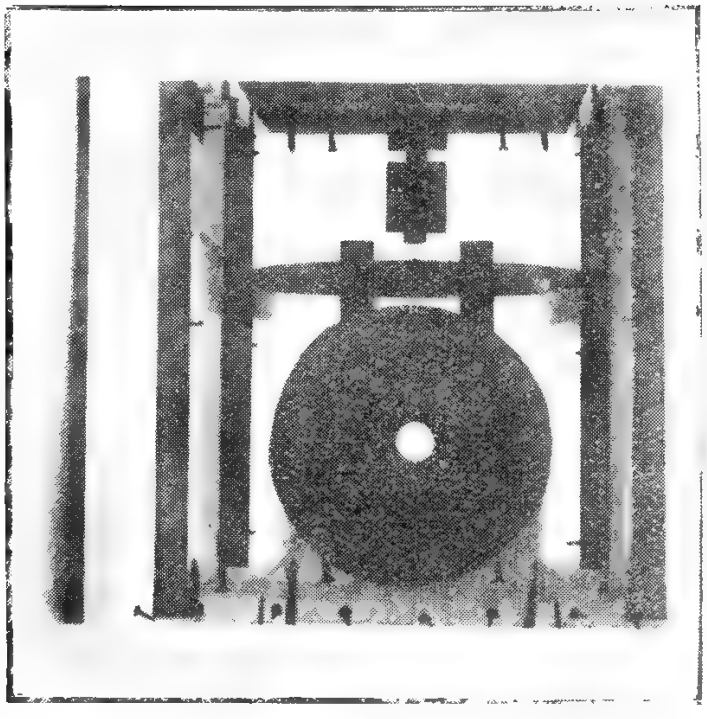


Fig. 8.—Skiagram of interior of instrument box.

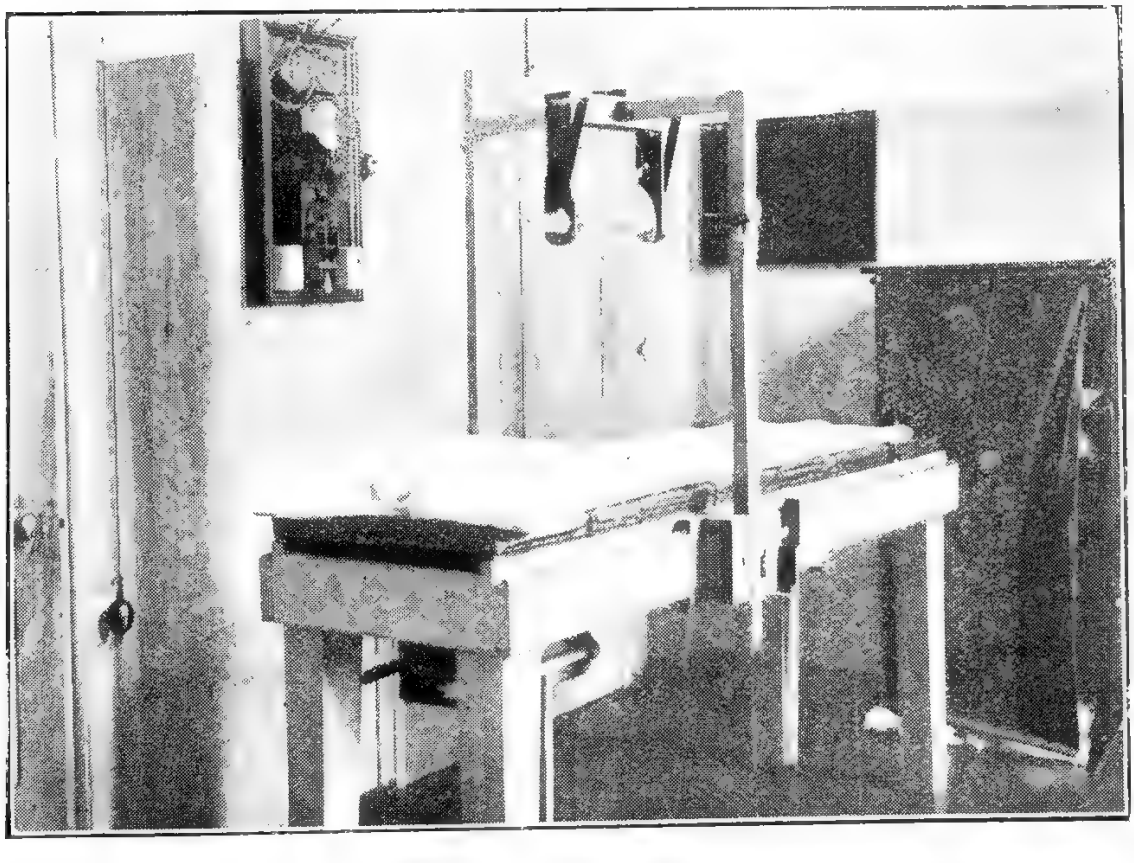


Fig. 9.—Localising apparatus for estimating depth of foreign body.

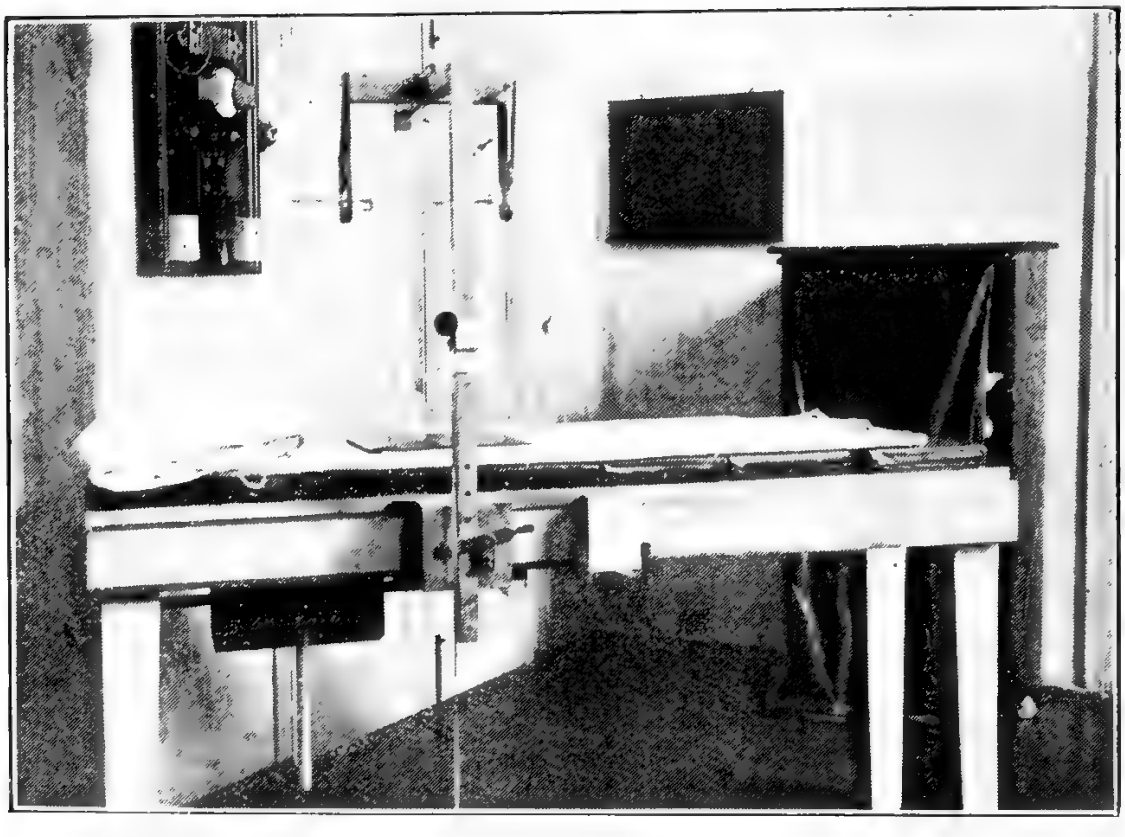


Fig. 10.—Localising apparatus showing sighting level and measuring tape.

Fig. 11.—Part of X-ray Department, Perth Public Hospital, showing switchboard and part of high tension apparatus.

Fig. 12.—Navy cot-bed with rule above.

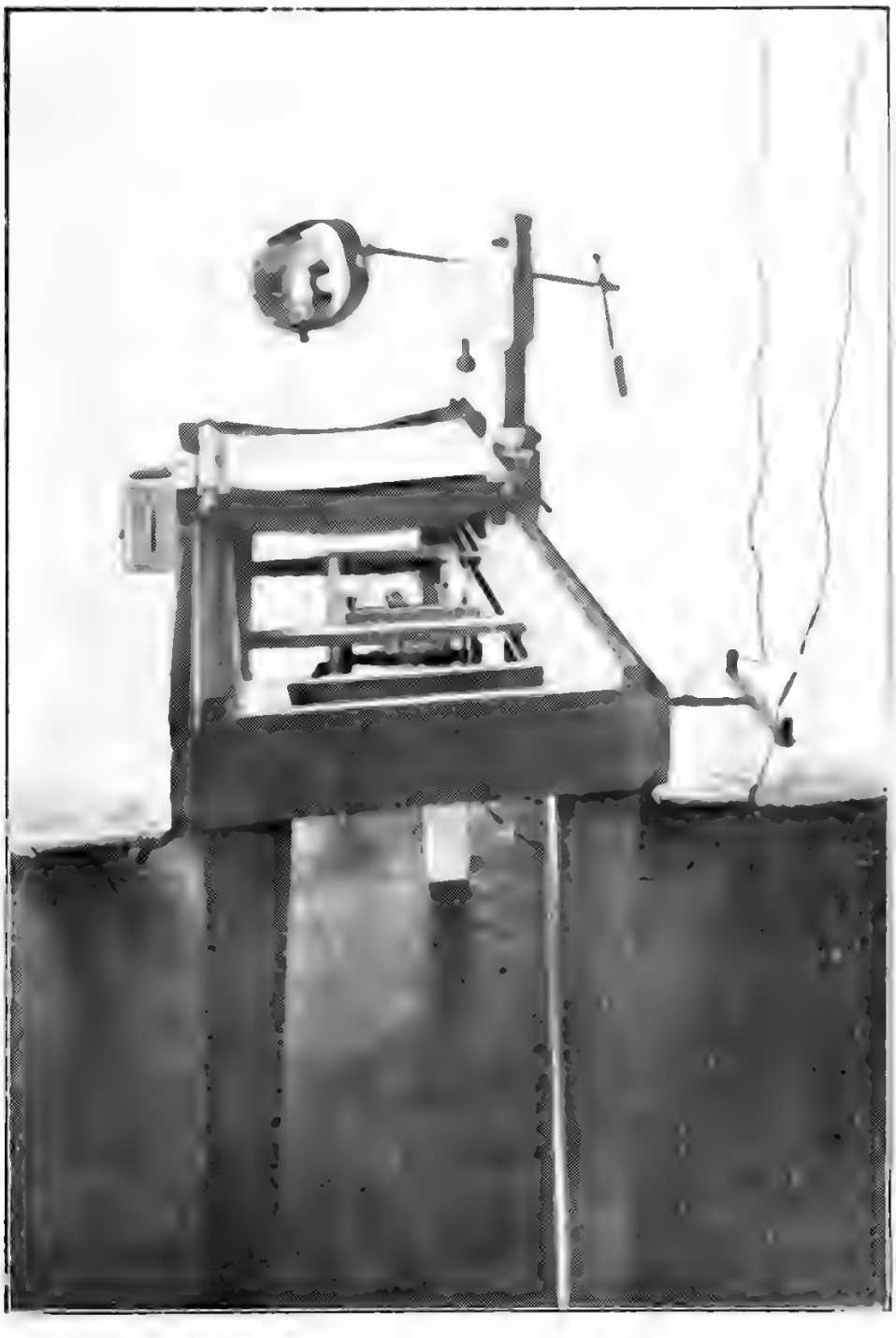


Fig. 13.—X ray table with tube below.

HISTORY OF ZOOLOGY IN WESTERN AUSTRALIA.

PART 3. 1829 1840.

(By W. B. Alexander, M.A., Keeper of Biology in the W.A. Museum.)

Read: May 8, 1917.

In two previous papers[1] I have traced the history of our knowledge of the animals of Western Australia up to the period when the first settlers arrived at the Swan River in 1829. In the following account I propose to continue the narrative up to the year 1840.

The first ten years of the Swan River Colony were naturally marked by a great increase in the knowledge concerning the animals of the western half of the continent. Many of the early settlers collected specimens and transmitted them to England and other countries of Europe, where they found their way into public and private collections and were described from time to time at the meetings of learned societies. In addition to these somewhat casual collections, professional collectors also visited the colony, natural history collections were formed on some of the more important exploring expeditions, especially those of Captain Grey, whilst the last of the surveying voyages which gave us the map of Australia, that of H.M.S. "Beagle," under Captains Wickham and Stokes, led to the discovery of numerous animals in the unknown North-West.

1829.—During 1829 many short expeditions were made in different directions to look for land for settlement, and the narratives of the leaders of several of these were published, but give little information about the animals seen.

Lieut. Preston[2] with a party of officers and men of H.M.S. "Sulphur," followed the valley of the Canning River across the Darling Range in September, and records seeing an Emu, a Swan, Cockatoos, and Parroquets, Native Dogs, Kangaroos, and Kangaroo Rats, on the journey.

In November, Mr. Collie[2] and Lieut. Preston explored the coast between Cockburn Sound and Geographe Bay, and noted Pelicans, Gulls, Swans, Ducks, and other waterfowl.

1 Journ. of W.A Nat. Hist. & Sci. Soc., Vol. V., 1914, pp. 49–64.
Journ. of Roy. Soc. of W.A., Vol. I., 1916, pp. 83 149.

2 Stirling, Sir J.: Journals of Several Expeditions made in Western Australia, 1829 32. London, 1833.

Lieut. Breton,[3] who spent five weeks in the colony in October and November, noted that at Swan River the animals "are of the same description with those on the East Coast, and the only noxious beast is the native dog, or wolf of this country."

On both the Swan and Canning Rivers, he found "black swans, ducks, teal, widgeon, and other birds; they were rapidly decreasing, the constant warfare kept up against them on the part of the colonists being so active, that scarcely one of the feathered race could escape them." He records that on one of his excursions "The birds shot during the day by a party of six persons, consisted of a swan, a duck, a teal, three cockatoos (two were white, the other black), and a host of the smaller kind of parrots." The only other bird he refers to is "The Common Crow."

He caught three scorpions in his tent, and one evening "an incredible number of winged ants entered and almost covered the sides of it, besides flying into our tea, and almost extinguishing the candles." But he states that "the blow-fly is a greater nuisance than all the other insects and reptiles united, an officer at Swan River found his carpet-bag swarming with the progeny of this loathsome insect."

Lieut. Breton visited Garden Island, where "the only animal found was the Wallabee Kangaroo,* with an occasional seal." "It may possibly prove an eligible spot for the establishment of a fishery, as snappers and other fish were abundant. Sharks also of large size are seen both in Cockburn Sound and Gage's Roads; we had one of these monsters alongside the vessel, and its length was certainly not less than twenty or twenty-two feet." "I found a specimen of the bêche de mer, but believe it is not common there."

Letters written in November by various settlers[4 & 4a] mention Kangaroos, Kangaroo-rats, and Opossums, among the Mammals. Of birds, they record the occurrence of Emus, Quails, Pigeons, Black Swans, Wild Ducks, Widgeons, Pelicans, Cockatoos, Parrots, Parroquets, Crows, Jays and Flycatchers. Lizards and Venomous Snakes are also mentioned. Fish are stated to be plentiful, beautiful shells are found on the coast, but the Mosquitoes are very annoying at night.

Mr. Spencer Trimmer states[4a] that "several persons who have been into the interior of the country amongst the Lagoons, describe an animal which they have seen as being like the hippopotamus; many traces have been seen of a large animal on the banks of the river."

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* Dama Wallaby (Macropus eugenii, Desm.).

3 Breton, Lieut. H. W.: Excursions in New South Wales, Western Australia, and Van Diemen's Land, 1833.

4 Powell, Rev. J. G.: Narrative of a Voyage to Swan River, 1831.

4*a* Extracts of Letters from Swan River: J. Cross, London, 1830.

The last visitor to the Swan River Settlement in 1829 of whose observations we have a record was Dr. T. B. Wilson.[5] Dr. Wilson arrived at Fremantle with Captain Barker and members of the Raffles Bay Settlement, which had just been disbanded, on October 17, 1829. During the month that he spent at the settlement, he made several expeditions. On one of these he met with natives in the Darling Range, who had "their noses ornamented with the leg bones of the kangaroo, and one of them had his head decorated with the red feathers of the black cockatoo. One of them procured a handful of loathsome-looking grubs from a grass-tree."

On a visit to Rottnest Island "the dogs caught two wallabi" * and one of the party shot a snake about five feet long. On the south-west side of Garden Island "we perceived a seal making for the shore; he waddled some distance up the sandy beach, and, after looking around, lay down at his ease, intending, no doubt, to enjoy repose."

Dr. Wilson went on with Capt. Barker to King George's Sound, where they arrived on Nov. 29, the latter taking over the command of the settlement. During the short time that Wilson spent here, waiting for a ship to sail for Sydney, he made a considerable exploration to the north-west, discovering the Kent, Denmark, Hay, and Sleeman rivers and the inlet which Sir James Stirling named Wilson's Inlet in his honour. On this expedition, in which he was accompanied by Mr. Kent, he met with abundance of kangaroos, a few bandicoots, black snakes, black cockatoos, the bell bird, black swans, ducks, teal, and other aquatic birds. He was also the first to record the occurrence of leeches, which he calls "the true *Hirudo medicinalis.*" †

On a subsequent short expedition to Oyster Harbour the only animals he mentions are wild ducks. He left King George's Sound on Dec. 20.

In a letter, dated Fremantle, December 12, 1829, a settler[4a] mentions that "the fish is very excellent; one kind in particular, it being something like skate, but very superior and much larger; there are also whitings, etc."

1830.—Mrs. Jane Roberts,[6] who arrived at Fremantle in Jan., 1830, and remained there seven weeks, tells us practically nothing about the animals she saw.

A settler who had made an expedition by boat to the southward of Fremantle told her that "he should never forget the sight

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* Quokka or Short-tailed Wallaby (Macropus brachyurus, Q. & G.).

† Hirudo australis, Bosisto.

4*a*. Extracts of Letters from Swan River: J. Cross, London, 1830.

5 Wilson, Dr. T. B.: Narrative of a Voyage round the World, 1835.

6 Roberts, Jane: Two Years at Sea, 1834.

of thousands and tens of thousands of black swans, which, as his party coasted the shore, rose and darkened the air for the distance of eight or ten miles."

She mentions that "the buzz and sting of the mosquitoes and the constant snapping noise of the lizard" disturbed her at night.

A military officer,[4a] writing at the end of the summer (? January or February, 1830), says that "the rivers are enlivened by numerous flocks of wild ducks, teal, wigeons, etc., and in particular, the black swan, which has been much persecuted, and is now rather shy, but is still frequently seen in large flocks; and by the pelican, a still larger bird than the swan. These rivers also swarm with fish of several kinds, all excellent eating, and easily caught. They also contain a singular amphibious animal, between a turtle and a tortoise,‡ about twelve inches long, which makes very excellent soup. Besides the water-fowl, our gunners have found great numbers of the white and black cockatoo, of a large kind, and very good eating; quails, and two or three varieties of pigeons. There are also crows, magpies, eagles, hawks, owls; and near the coast are several kinds of gulls, sandpipers and other sea-birds, and great numbers of paroquets all over the country. We are totally exempt from reptile nuisance. We have a number of such snakes as are found in New South Wales. Such as the diamond snake, which has been killed of a length exceeding nine feet, but quite harmless." The large timber is often found to be hollow at heart, owing to the ravages of a kind of white ant.

In August, 1830, Ensign Dale[2] made an expedition to the eastward of the Darling Range. The only animals he recorded were a litter of native dogs. He saw tracks of emus.

In September Lieut. Erskine[2] also made an expedition to the east of the Darling Range and records seeing numerous kangaroos, tracks of emus, and black swans on the Avon River.

Between Oct. 25 and Nov. 7, 1830, Ensign Dale[2] made another expedition beyond the Darling Range. Mr. T. W. Harvey,[2] who accompanied him, wrote a fuller account of the expedition than did Dale. They penetrated 100 miles east of Swan River. They saw many kangaroos, chiefly of "the large kind, which are properly called forest kangaroos," and on Oct. 27 killed "a small one of another kind, called the mountain kangaroo." The previous day they had found an emu's nest in which the shells of the eggs only remained, the young ones having been hatched some time.

They saw many white cockatoos, and Harvey states "the white cockatoo appears to live on what it takes from the ground, whether insects or roots I am not able to say. The black kind live on the buds of large trees and shrubs."

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‡Chelodina oblonga, Gray.

2 Stirling, Sir J.: Journals of Several Expeditions made in Western Australia, 1829–32. London, 1833.

4*a* Extracts of Letters from Swan River: J. Cross, London, 1830.

On Oct. 30 on the top of Mt. Elizabeth they found "an astonishing number of lizards." He also mentions "an arched piece of rock, with several birds' nests adhering to the top. From their peculiar construction and composition I judge they belong to the swallow tribe* but very different from those seen in England."

On pools of fresh water they saw ducks, also musk ducks, when mentioning which Harvey says "these birds cannot fly." In the pools were some small fish.

In a Government Notice[2] published this year giving particulars as to the district about Port Leschenault it is recorded that wild ducks and cockatoos had been met with. Large mussels had been observed in the Preston River, and small fish in pools in a tributary of the Collie.

1831.- Writing in March, 1831, Mr. G. F. Moore,[7] who had arrived in the colony at the end of the previous October, gives the following account of the animals met with about his homestead near Guildford:—

"The kangaroo has supplied food to many who were prudent or fortunate enough to provide themselves with proper dogs. The only other animals you meet with usually, are, the opossum, the kangaroo rat, lizards, rats and mice, the rat not much larger than the English mouse; they are abundant and mischievous.

"I have heard of emus; and have seen wild turkeys, cockatoos, parrots, pigeons, quails, pies, jays, hawks, black swans, pelicans, and a number of other birds.

"This day I shot a duck. There are two kinds of them; one of which, the wood duck,† alights on trees. The white cockatoos‡ are very numerous, and now feed upon the flower of the red gum tree, which lately came into blossom. There are three or four species of the cockatoo,—white, black, grey, and black with a red tail. The parrots are small and green, the neck ornamented with a gold ring.§ The pigeons are beautiful, with a bronze-coloured wing.‖ Many birds have singular calls or cries, and our crow makes a most dismal noise, terminated by a long doleful cry. The white cockatoo screams like a clucking hen disturbed from her nest, and the black one whines like a discontented pug-dog. There is a bird called here the robin,¶ like our own in its habits of familiarity, but its plumage is much more beautiful; a thrush resembling the fieldfare;$ a

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* Nests of the Fairy Martin (Lagenoplastes ariel, Gould).
† Wood-Duck (Chenonetta jubata, Latham).
‡ Long-billed Cockatoo (Licmatis tenuirostris, Kuhl).
§ Twenty-eight Parrot (Barnardius zonarius, Shaw & Nodder).
‖ Bronze-wing Pigeon (Phaps chalcoptera, Latham).
¶ Scarlet-breasted Robin (Petroica multicolor, Gmelin).
$ Buff-bellied Shrike-Thrush (Colluricincla rufiventris, Gould).

2 Stirling, Sir J.: Journals of Several Expeditions made in Western Australia, 1829–32. London, 1833.

7 Moore, G. F.: Diary of ten years eventful life of an early settler in Western Australia, 1884.

small bird the size of a wren, but of splendid ultramarine colour.* There are many other varieties but I have not time to enumerate them.

"Fish abound in the river, but without a net of peculiar construction (a trammel net) it is not easy to catch them—I have taken a few perch, however, one small turtle, and shell fish like the clam.

"Insects are now wonderfully numerous. Ants in great quantities and of many varieties of size and colour, from the lion ant, an inch long, to the small brown ant, which can insinuate itself into the most minute crevice. These seize upon whatever is eatable, and devour it in a short time. The ground seems alive with white ants, and the trees swarm with them inside and out; everything here teems with life.

"Of snakes I have seen only two, both very small; but my men have killed five or six, some of them three feet long; we have not heard of any injury being done by them, and in fact they do not seem to be at all dreaded."

In an account of the country intervening between Augusta and Swan River[2] (probably by Mr. Bussell) the author mentions that on March 16 he found the head and part of the body of a sea-horse on the shore. On April 6 they killed a sturgeon (?) and also found great quantities of periwinkles of a large size.

In April, 1831, a party[2] exploring the south coast in a whale boat visited Nornalup Inlet where they caught many small snappers and killed two swans. Near Point d'Entrecasteaux they had to abandon their boat, and made their way to the Murray River overland. On the Blackwood River they saw plenty of swans and ducks, and about the Vasse River many large kangaroos. At the Preston River they caught some cat-fish and killed four ducks.

Surgeon Collie,[2] the resident at King George's Sound, made an expedition northwards from that place at the end of April and met with "great numbers of kangaroos and several emus, not to mention a fair proportion of ducks, cockatoos, pigeons, etc."

Moore[7] writes on May 28: "The numerous frogs remind me that the moist weather and approaching winter have brought into active life an immense quantity of these creatures, some of which make a hard co-ax, co-ax sort of noise, and others a most mournful and horrible bellowing, which might be mistaken for the high note

On June 4 he found a wild turkey,†[12] which had been wounded, "it measured seven feet from tip to tip of the extended wings; the thighs like those of a lamb."

* Banded Blue-Wren (Malurus splendens, Q. & G.).

† Bustard or Wild Turkey (Austrotis australis, Gray).

2 Stirling, Sir J.: Journals of Several Expeditions made in Western Australia, 1829–32. London, 1833.

7 Moore, G. F.: Diary of ten years eventful life of an early settler in Western Australia, 1884.

12 Irwin, F. C.: State and Position of Western Australia; the Swan River Settlement, London, 1835.

On the same date Collie[2] paid a visit to Coffin Island, King George's Sound. "Upwards of five hundred mutton-birds (sooty petrel, *Procellaria fuliginosa*)* were caught. Sooty petrels, penguins, lizards, etc., have riddled the ground with their holes. Rock and other fish are plentiful, and several whales were observed."

On June 9, Moore[7] "caught in the garden a beautiful snake, about eighteen inches long, with a black head and yellow body; put him into a bottle of rum, along with many other such things; he vibrated his tongue most rapidly and wickedly. Caught a centipede, nearly four inches in length; it is in the bottle of *preserves* also."

On June 13th he "shot a bird which some call a squeaker."†

On the 16th he notes: "Crows are very persevering and destructive; shot one, with its stomach full of wheat." Next day he got a "brush kangaroo,‡ about fifteen pounds weight."

Aug. 1st, Mr. Burgess's dogs had killed an old and young emu. "The old one, when erect, is nearly seven feet high, and resembling the kangaroo, both being small and slender in the fore parts and heavy and strong in the hind-quarters. This bird has a very gentle look, seems to feed entirely on grass, has no wings, and scarcely the indication of a pinion, for it is only six inches long, terminated by a small claw. The feathers are singular, two of them springing from one stem; the only long ones are in the tail; the colour is of a dark brown. The young one is not unlike a gosling, with light-coloured longitudinal stripes."

Aug. 3rd, "I have found a beautiful frog mottled with bright green."§

Aug. 13th, "I have been favoured with two new songs from birds like thrushes; the notes are not much varied, but seem rather a repetition of something corresponding with these words, "come with me and let us make a nest, ah! *do.*" To which the other seems to reply, "No, indeed I shan't, at least with *you.*" The last note accented."

On Aug. 19, Moore records that seven spermaceti-whales had appeared off Fremantle; next day that the blow-flies had taken a fancy to his new blankets, which had been so covered by them as to require fumigation with brimstone to effect their dislodgment.

On Sept. 6 a party, led by Mr. Dale, travelled over the hills to found the settlement of York; subsequently Mr. Dale explored the Avon Valley for a considerable distance south and north of the new

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* Flesh-footed Petrel (Hemipuffinus carneipes, Gould).

† Leaden Crow-Shrike or Squeaker (Neostrepera versicolor, Latham).

‡ Black-gloved Wallaby or Brush Kangaroo (Macropus irma, Jourd).

§ Hyla aurea, Less.

2 Stirling, Sir J.: Journals of Several Expeditions made in Western Australia, 1829–32, London, 1833.

7 Moore, G. F.: Diary of ten years eventful life of an early settler in Western Australia, 1884.

settlement, and proved that the Avon was the upper part of the Swan. Mr. Moore was a member of this party, and his account of the expedition gives fuller particulars of the animals met with than does that of the leader.

Kangaroos were seen plentifully throughout the journey.

On Sept. 15th they caught "two iguanas, 14 inches long, with a purple tongue, and without a tail.* One of the party killed "what he called a puff adder, and a small snake."

At York they saw turkeys, ducks, and cockatoos, also "many burrows like badger earths," and in the Avon "something stirring, which was conjectured to be a platypus, but naturalists have not yet ascertained that it exists here."

South of Beverley, on Sept. 21st, they "saw a beautiful animal; but as it escaped into the hollow of a tree, could not ascertain whether it was a species of squirrel, weasel, or wildcat." Next day they reached a lake on which was "an immense number of ducks, swans, and other waterfowl." They "met with a large native dog, and chased another little animal, such as had escaped from us yesterday, into a hollow tree, where we captured it; from the length of its tongue, and other circumstances, we conjecture that it is an *ant-eater*—its colour yellowish, barred with black and white streaks across the hinder part of the back; its length about twelve inches.†

On Sept. 23rd, they saw cockatoos and emus, and turned back at a point about 60 miles S.S.E. of York. Nothing noteworthy is recorded on their journey back to Guildford. Moore adds: "Of birds we saw no great variety; mocking birds, parroquets, larks, and warblers, but none very beautiful. I have mentioned already all the other animals which we obtained sight of, except some reptiles, viz., three or four snakes."

On Nov. 4th, Moore records in his diary that his man "brought home a turtle‡ yesterday, and to-day another, which he found in the grass, where they had been depositing their eggs; their weight is four pounds each, and one had sixteen eggs with remarkably hard shells. Found a pretty rail, shaped like ours, but handsomely freckled; and a young wagtail,§ which has as varied a style of singing as it has various names, being called, besides the name just stated, razor-grinder, and superb-warbler." Dec. 7th.—The indefatigable little warbler, or razor-grinder, is singing its sweet notes at nine o'clock, p.m., by beautiful moonlight; it is a very fearless little bird, associating with all the farm and domestic animals, watching attentively for flies, at which it springs with unerring aim, twittering out every now and then, by way of interlude or for the sake of good digestion, some of its sweetest notes."

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* Stump-tailed Lizard (Trachysaurus rugosus, Gray).

† Banded Ant-eater (Myrmecobius fasciatus, Waterh).

‡ Chelodina oblonga, Gray.

§ Wagtail or Black-and-White Fantail (Leucocirca tricolor, Vieillot).

[On Nov. 22, 1831, at a meeting of the Zoological Society of London, "the skins were exhibited of two animals forming part of a small collection of Mammalia and Birds brought from the neighbourhood of Swan River by Lieut. Matthew Friend, R.N., and presented by him to the Society." (P.Z.S. 1831.) Mr. Ogilby described them as new to science under the names of *Hypsiprymnus setosus* and *Ornithorhynchus brevirostris*. It seems certain that these animals were not really from Western Australia, the former is a synonym of *Potorous tridactylus* of S.E. Australia and Tasmania, the latter of *Ornithorhynchus anatinus*, which has the same distribution.]

1832.—On April 4, 1832, Moore notes in his diary: "No two birds can be more different in outward appearance than crows and cockatoos, yet in their habits they are similar; they go in flocks, call and give the alarm to one another, and fly off with a noise equal to that of a rookery."

On May 3rd, he records shooting a kangaroo and an eagle and catching "a young kangaroo rat, which I have still alive; it is soon a tame thing, very like a kangaroo in miniature, but with a head larger in proportion, and with hair or fur of coarser texture." On the 10th he records shooting "bitterns, pigeons, and parrots on the margin of a lake ten miles in circumference, where we saw swans and ducks in abundance."

On Aug. 6th he mentions that "a wild bull was caught and killed the other day; and a great sensation has been created by a rumour that thirty-six head of wild cattle has been seen."

On Sept. 14th, 1832, he writes: "The cockatoos are gregarious and migratory: at some periods of the year few are to be seen; at other times, they are seen in large and frequent flocks."

"Many persons are trying to salt fish, which are very numerous in the river about and below Perth, on one occasion we took 10,000 at one draught of the seine; these are of the kind *called* herrings, but do not look very like them; they make a noise when out of the water, and on that account are also called trumpeters. The rack, or kingfish, is as large as a salmon; the schnapper, or bream (a deep-sided fish, not unlike the roach), the mullet, a thick-shouldered, blunt-headed fish, the silver-fish (perch), and the guard fish, sometimes come up the river. There is another species, somewhat of the nature of an eel, with a sharp spine, which it can erect at pleasure; this is caught only in the fresh water, and is called a cobbler; a kind resembling it in salt water is named cat-fish. Perch will take no bait except the shrimps which are found about stumps of trees and logs of timber in the river. The snake-necked turtle sucks your bait off most ingeniously. We have the cray-fish from two to six inches long, and clams in abundance. These are all the productions of our river as far as we are yet acquainted with them. There are crabs in the salt water, different in shape from the British, and so

very daring that they have seized me by the foot frequently when pushing boats over the flats. Neither lobsters nor oysters have been found, though the *shells* of the latter are very numerous about the flats and Melville Water."

On Nov. 1st Moore records that he "shot a duck on the wing, and found that it had a nest with ten eggs."

Dec. 12th, "the dogs killed a long-tailed, yellow-spotted iguana, and a black one: The first had eggs."

A journey undertaken by Mr. Bussell[2] must have been made during 1832 or earlier. He mentions in it that about the Vasse River "cockatoos were in greater multitudes than I have ever witnessed before, white and black." Kangaroos and emus were abundant there, and he saw "a cloud of ducks" on the river.

1833.—Jan. 14th, 1833, Moore notes in this diary that he "found a diamond snake round a tree, it was almost five feet long."

On the 17th he "went to some swampy ground full of springs to look for ducks; shot a brace, besides a water hen and a cockatoo. I was actually driven out of the swamps by leeches, several of them sticking to my legs."

On Feb. 15th Capt. Irwin, the Lieutenant Governor, and Mr. Moore embarked on the schooner "Ellen" to proceed to King George's Sound; the wind forced them to put back for shelter and they spent the 16th on Carnac Island. Moore states that the "men took some young mutton-birds* in the holes in which they burrow like rabbits; and the natives of our party begged hard to remain all night, in order to catch the old ones in their holes, which they do not enter before nightfall."

Nothing noteworthy is recorded during the few days they spent at Albany. On the return journey they stopped at Augusta and on the flats in the Blackwood River saw "numbers of ducks and upwards of a hundred swans." They saw "many seals of the most valuable species upon the rocky islands of Cape Lewin."

On June 21st Moore writes: "I had an opportunity lately of seeing some of the domestic arrangements of the white ants. Upon the brow of a small rounded eminence there stood a sort of a pillar of clay, about 5 feet high, which had once filled up the centre of a hollowed tree, the shell of which had been from time to time broken and burned away. This pillar was the work of white ants. As it interfered with the working of the plough, I commenced breaking and digging it down, not without some small curiosity. Numbers of centipedes were found about the outside, where pieces of the wood still remained. The clay, which was surprisingly stiff, hard, and dry, broke off in large fragments. At length, near the level of the surface of the ground, a rounded crust was uncovered looking

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* Wedge-tailed Petrel (Thyellodroma pacifica, Gmelin).

2 Stirling, Sir J.: Journals of Several Expeditions made in Western Australia, 1829–32, London, 1833.

like the crown of a dome. On breaking through this, the whole city of the ants was laid bare—a wonderful mass of cells, pillars, chambers, and passages. The spade sunk perhaps two feet among the crisp and cracking ruins, which seemed formed either of the excavated remnants of the tree, or a thin shell-like cement of clay. The arrangement of the interior was singular: the central part had the appearance of innumerable small branching pillars, like the minutest stalactical formations, or like some of the smaller coralline productions. Towards the outer part, the materials assumed the appearance of thin laminæ, about half the substance of a wafer, but most ingeniously disposed in the shape of a series of low elliptic arches, so placed that the centre of the arch below formed the resting-place for the abutment of the arch above. These abutments again formed sloping platforms for ascent to the higher apartments. In other places I thought I could discern spiral staircases, not unlike geometrical staircases. The whole formed such an ingenious specimen of complicated architecture, and such an endless labyrinth of intricate passages, as could bid defiance alike to art and to Ariadne's clue: but even the affairs of ants are subject to mutation. This great city was deserted—a few loiterers alone remained, to tell to what race it had formerly belonged. Their great storehouse had been exhausted—even the very roots had been laid under contribution; till at last its myriads of inhabitants had emigrated *en masse,* to commence anew their operations in some other soil."

At a meeting of the Entomological Society[8] of London on Dec. 2, 1833, the Rev. F. W. Hope described a number of new beetles, among which were six species from the Swan R., two of which had been sent by Capt. Roe.

Capt. Stokes[9] records that "a singular flight of strange birds was noticed at Guildford about the year 1833, during the time when the corn was green: they arrived in an innumerable host, and were so tame as to be easily taken by hand. In general appearance they resembled the land-rail,* but were larger, and quite as heavy on the wing. They disappeared in the same mysterious manner as they arrived."

1834.—At a meeting of the Entomological Society[10] of London on Feb. 3, 1834, Mr. G. R. Gray described a new species of Stick-Insect (Phasmid) from the Swan River under the name of *Phasma spinosum*; whilst at a meeting of the same Society on May 5, Rev. F. W. Hope[11] described a new species of weevil (Curculeonid) under the name of *Amycterus schönherri.*

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* Black-tailed Native Hen (Microtribonyx ventralis, Gould).

8 Trans. Ent. Soc., London, Vol. I., p. 11, 1836 (5 of the species are figured).

9 Stokes, J. L.: Discoveries in Australia by H.M.S. Beagle, 1837–43. London, 1846.

10 Trans. Ent. Soc., London, Vol. I., p. 45, 1836.

11 Trans. Ent. Soc., London, Vol. I., p. 68, 1836 (the species is figured).

On May 3 Moore records in his diary that "the natives have been feasting on a sort of grub or worm which they find in numbers under the bark of the red gum trees. Those that I have had cut down present a fine store for them to have easy access to. The grub is a sort of long four-sided white worm or maggot, with a thick, flat, square head and a small pair of strong brown forceps set on the end of the head."

1835.—Capt. F. C. Irwin, who was in command of the troops with the expedition that founded the colony in 1829, and during over a year in 1832-33 administered the government of the colony whilst Sir James Stirling was in England, published in 1835[12] a book on Western Australia.

Writing of the fisheries, he states that "there is a plentiful supply of white fish on the coast, including the snapper, and many others not known in Europe. Fish have been taken in large quantities off Rottnest Island, in Cockburn Sound, at the Murray River, and elsewhere. There is. it is believed, no frequented coast where whales are found in greater abundance. When at Port Leschenault, the writer was told by the officer commanding there that he had counted fourteen in the bay at once. During a voyage of the "Sulphur" down the coast three hundred are said to have been seen. Some of these fish were declared to be sperm, by men of the ship who had been whalers; but it is chiefly the black whale that frequents the coast.

Soon after the "Sulphur's" arrival her crew, with that of the "Challenger," were engaged in fishing; and on one occasion they caught so vast a quantity of a species called the King fish that the net they were using broke, and the fish were literally driven on shore. Upwards of three hundred people were amply supplied on this occasion. Close to Garden Island is a bank on which the finest whiting are caught in great quantities. The crew of the colonial schooner "Ellen" caught on the Five Fathom Bank outside of that island, a place greatly frequented by the snapper—in less than two hours, and with half a dozen hooks and lines—fish of that description, to an extent exceeding five cwt. Some of them weighed from 20 to 40 lbs. each."

On Feb. 6, 1835, Mr. Moore, writing of the district about the Hotham River, states that "kangaroos are so abundant and tame that they were shot as often as required, and cockatoos so numerous as almost to prevent conversation by their noise."

[On April 28, 1835, at a meeting of the Zoological Society of London,[13] "Mr. Gray exhibited a specimen of a Toad, which he had recently received from Swan River, whence it was sent to him by Joseph Wright, Esq." He described it as new under the name of

12 Irwin, F. C.: State and Position of Western Australia; the Swan River Settlement, London, 1835.

13 Proc. Zool. Soc., 1835.

Bombinator australis. The locality given is almost certainly incorrect as the species appears to be confined to New South Wales.]

On May 6, Moore[7] noted in his diary: "One of the little native boys was busy eating frogs to-day. They looked so tempting that I ate one also, and it was delicious. The part I ate, however, was the eggs of the female, which they seem to prize most, as they say, 'The men frogs are no good.' The taste was much like that of an egg. It strikes me that I have never seen here in the pools the frog spawn, and these eggs, judging by their appearance when the frog was roasted, looked like little white eggs, distinctly formed, and not globular jellies with the embryo, like a black speck, as they are at home. The natives dig them out of the ground with their hands. There is no water now, nor none since winter last, when these were got. How do they live; Do they sleep?"

On June 23rd he adds: "It appears that the natives do not consider every frog fit for eating, for some of a greenish colour were under the stack, but they would not eat them, and said they lived above the waters, but the good ones lived in the ground."

On the same date he mentions that "white cockatoos * are becoming very troublesome upon the wheat, as well as the crows. One is obliged to keep a boy to drive them away, or to make some contrivance to frighten them. We strike a long board smartly with a stick, the sound of which frightens them a little. It is singular to see a field spotted black and white with these depredators 'piebalded.'"

In November he writes in reply to a request for some live cockatoos that "it is very difficult to obtain them here, for they do not build their nests in this neighbourhood (as the natives inform us), and an old one would not do."

On Nov 2, 1835, at a meeting of the Entomological Society of London,[14] Mr. G. R. Waterhouse contributed a "Monograph on the Coleopterous genus *Diphucephala*, belonging to the Lamellicornes,' in which he described as new two species from Swan River, *D. hopei* and *D. edwardsii*.

Moore writes in December: "Walking to-day through the lucerne, which is now in full flower, my ears were saluted with the familiar sound of the humming of bees; on watching narrowly I saw a great number as busy as I ever saw them on a heathy hill. They are not unlike the common garden bee, rather more active and restless on the wing; but this might have been owing to the day, which was very sultry, with high wind, thunder and lightning. Their thighs were laden with farina, their honey-bag was filled, and

* Long-billed Cockatoo (Licmetis tenuirostris, Kuhl).

7 Moore, G. F.: Diary of ten years eventful life of an early settler in Western Australia, 1884.

14 Trans. Ent. Soc., London, Vol. I., p. 215, 1836.

they have a good sting, which they know well how to use, as I can testify. I tried to trace them to their nest, but the day was so murky I could not distinguish them at any distance."

1836.—On March 6, 1836, Charles Darwin,[15] in his voyage round the world on H.M.S. "Beagle," arrived at King George's Sound. He writes that "we stayed there eight days; and we did not during our voyage pass a more dull and uninteresting time . . . he who thinks with me will never wish to walk again in so uninviting a country."

On July 12, at a meeting of the Zoological Society[16] of London, "Mr. Waterhouse described a new mammal, probably of the marsupial type, under the name of *Myrmecobius fasciatus* (n. gen., n. sp.). The skin had been lent by Lieut. Dale, of Liverpool, who procured it whilst on an exploring party in the interior of the Swan River Settlement, about 90 miles to the S.E. of the mouth of that river (see *ante*, p. 40). Two specimens were seen; both of which took to hollow trees on being pursued, and one of them was unfortunately burned to death in the attempt to dislodge it from its retreat. The country abounded with decayed trees and ant-hills; and from this circumstance, and from some peculiarities in the structure of the animal, Mr. Waterhouse believes that it lives chiefly if not wholly upon ants. Lieut. Dale states that, when it was killed, the tongue was protruded from the mouth to the extent of two inches beyond the tip of the nose, its breadth being three-sixteenths of an inch."

On Sept. 27, "a small collection of Birds from Swan River, presented to the Society by Lieut. Breton and Capt. Brete, were on the table." Mr. Gould described two of them as new under the names of *Gallinula ventralis* * and *Oxyura australis*.

On Oct. 25 Mr. Gould described several new Australian birds, among them *Calyptorhynchus naso* † from the Swan River.

On Dec. 5, 1836, Mr. G. R. Waterhouse, at a meeting of the Entomological Society[17] of London, described some new species of exotic insects. Among them were a weevil, *Belus testaceus*, and two Homoptera, *Alleloplasis darwinii* and *Cephalelus marginatus*, discovered at King George's Sound by C. Darwin, Esq. The *Alleloplasis* was captured whilst "sweeping in coarse grass and brushwood."

On Dec. 13 Mr. Reid brought before the notice of a meeting of the Zoological Society[16] a new species of the genus *Perameles* found in Western Australia, and called by the natives *Dalgheit*, and by the colonists the rabbit. He described it under the name of

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* Microtribonyx ventralis.

† C. banksii, Lath.

15 Darwin, C.: Journal of Researches into the Natural History and Geology of the countries visited during the voyage of H.M.S. Beagle round the world, 1839.

16 Proc, Zool. Soc., London, 1836.

17 Trans. Ent. Soc., London, Vol. II., p. 188, 1840.

*Perameles lagotis.** "A friend of Mr. Gould's residing in Western Australia states that these animals are found beyond the mountains of Swan River in the district of York. They feed upon large maggots and the roots of trees, and do considerable damage to the maize and potato crops by burrowing. A specimen kept by him in confinement became in a few days very docile, but was irritable, and resented the slightest affront or ill usage. It took bread, which it held in its forepaws. A young one to which it gave birth unfortunately escaped, after being carried in the mother's pouch for several days."

Mr. Waterhouse exhibited a second specimen of *Myrmecobius*, and stated that "others similar to it were observed scratching at the roots of trees, and feeding upon the insects which are generally abundant in such situations." He gave an account of the anatomy of the animal.[18]

[At the time it was supposed that the specimens of both *Perameles lagotis* and *Myrmecobius* exhibited had come from Tasmania, but a letter from Alexander Gordon, Esq., read at a meeting of the Society on Nov. 13, 1838 (P.Z.S. 1838), stated that they were from Swan River.]

Mr. Bussell[19] records that "in Sept., 1836, I was becalmed in a small cutter off Point Piquet (Geographe Bay) for a day and a half; from thence whales were to be seen in all directions, sporting over a large expanse as smooth as a mirror."

1837.—On Jan. 2, 1837, Mr. G. R. Waterhouse[20] read at a meeting of the Entomological Society "Descriptions of some of the Insects brought to this country by C. Darwin, Esq." Amongst them were six species of *Haltica* and four of *Dibolia* from King George's Sound, all of which were described as new.

In May G. F. Moore records in his diary that a native boy "has just been telling me that a large hawk, when it discovers an emu's nest, takes a stone in its talons, hovers over the nest, and lets it drop among the eggs to break them. He laughed so slily whilst telling it that I think he was 'taking a rise' out of the white man."

In June he notes that "this day will be memorable in the annals of this colony for the killing of the first whale." And later in the same month he adds: "two whales have been killed within the last week, and a whale calf also, besides the mother or cow whale being wounded so severely that it is thought she will be taken also."

Other references to whales being captured occur at intervals later in his journal.

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* Thalacomys lagotis.

18 Trans. Zool. Soc., London, Vol. II., p. 149, 1841 (with a coloured plate and figures of the skull, limbs, etc.).

19 Ogle, N.: The Colony of Western Australia, 1839.

20 Trans. Ent. Soc., London, Vol. II., p. 131, 1840.

On Nov. 21, 1837, Mr. J. O. Westwood [21] read before the Linnean Society of London a paper "On the family Fulgoridæ, with a monograph of the genus Fulgora of Linnæus." A new species, *F. dilatata*, from Swan River, was described.

On Dec. 26, at a meeting of the Zoological Society,[22] "Mr. Gould exhibited a very extensive series of Australian birds principally from his own collection, including about eighty new species." Among them were four from Swan River, *Eopsaltria griseogularis*,* *Sittella pileata*,† *S. melanocephala*,‡ and *Anthochaera lunulata*.§

On Dec. 25, 1837, James Backhouse [23] (great-grandfather of the present writer) arrived at Albany from South Australia. From Sir Richard Spencer, the Government Resident, he learnt that "plenty of good fish is to be had, in the Harbours and the Sound: the Blacks catch a singular, bearded species, about one foot and a half long, among the sea-weed, with their spears." After passing Cape Leeuwin on Dec. 28th, on the 29th he saw some flying-fish, and reached Fremantle the same evening.

1838.—On Jan. 5, 1838, he "walked to Woodman's Point, seven miles from Fremantle, where there is a sand-spit or projecting shoal, on which some interesting shells are found. A Crowned Couch was in the act of burying itself in the sand, in the shallow water, at sunrise. There were vast numbers of sea-fowl at this point, at day-break. The variety of shells found here is considerable, and a slug,‖ more than a foot long, is also cast up on the beach, having a large, cartilaginous, internal shell."

On Jan. 6 he mentions that "a shark with a round nose was harpooned from the "Abercromby." It measured nearly ten feet in length. The head and shoulders of a sharp-nosed species, of not greatly inferior dimensions, that was killed on the previous day, were found in its stomach. Though these frightful animals are so numerous here no accidents have yet happened by them."

From a settler from the York district he learnt that east of York "there is a great range of extremely sterile country, almost destitute of water, but upon which the Brush Turkey¶ hatches its eggs in hillocks of sand."

On Jan. 30, after visiting Perth, he "returned to Fremantle in a boat. Numerous shoals of fish were sporting in the sunshine and multitudes of jelly-fish of great beauty were floating just beneath the surface of the water. One of these [of which a figure is given]

* E. australis, White.
† Neositta pileata.
‡ Neositta pileata, Gould.
§ A. chrysoptera, Lath.
‖ Tethys gigantea, Sowerby.
¶ Mallee Hen or Gnow (Leipoa ocellata, Gould).

21 Trans. Linn. Soc., London, Vol. XVIII., p. 133, 1841 (the species is figured).
22 Proc. Zool. Soc., London, 1837.
23 Backhouse, J.: Narrative of a Visit to the Australian Colonies, 1843

had a pellucid cap marked by a cross, with about ten brown spongy masses coloured with shining globules attached to it by four pellucid muscles; it had also about ten whitish, obtusely-terminated tentaculæ, and numerous smaller ones. Another [also figured] was like a glass saucer, with a fine, fibrous margin. It continually expanded and contracted, and had a quadrifoliate mark in the centre, above, and a number of short tentaculæ beneath."

On Jan. 31 he "walked about four miles on the road toward the Canning River, through sandy forest, covered with Grass Trees or Black Boys. Large grubs are found in the trunks or rootstocks of the Black Boys, which are esteemed a delicacy, both by the Natives and by such of the white people as have learned to eat them. Parrots, Piping Crows, and Australian Magpies were the principal birds we saw. Emus are sometimes met with in this district; one was chased a few days ago by the river-side."

On Dec. 2, 1837, Lieut. (afterwards Sir) George Grey [24] and Lieut. Lushington landed in Hanover Bay, in what is now the Kimberley division of North-West Australia. Here they remained until April 17, 1838, discovering the Glenelg River and exploring the country between it and the Prince Regent River. Owing to the very difficult nature of the country and the hostility of the natives they were not able to penetrate very far from the coast.

Grey gives the following details of the fauna of this district: -

"North-Western Australia seems to be peculiarly prolific in birds, reptiles, and insects."

"Of quadrupeds there are but few species and of these the individuals, considered in proportion to the surface they roam over, are rare. The only species I observed during a residence of five months, were four of kangaroos, viz., the large *Macropus giganteus* (?) * of Shaw, two smaller kinds, one of which is the *Petrogale brachyotis* of Gould, and a kangaroo-rat, which last is always seen amongst the rocks on the sea-coast. One species of opossum, a flying squirrel (*Petaurista*), † two kinds of dogs, of which one is new, rats, and a field-mouse. Of these the kangaroos were alone numerous, and only in particular spots. I shot a female kangaroo of the *Petrogale brachyotis* near Hanover Bay, and by the preservation of the skin and other parts, enabled Mr. Gould to identify it as a new species. "This graceful little animal is excessively wild and shy in its habits, frequenting, in the daytime, the highest and most inaccessible rocks, and only descending into the valleys to feed early in the morning and late in the evening. When disturbed in the daytime, amongst the roughest and most precipitous rocks, it bounds along from one to the other with the greatest apparent facility, and

* Perhaps M. robustus woodwardi, Thos., certainly not M. giganteus.

† Petaurus breviceps, Waterh.

24 Grey, G.: Journals of two expeditions of discovery in North-West and Western Australia, during the years 1837, 8 and 9, London, 1841.

is so watchful and wary in its habits that it is by no means easy to get a shot at it. One very surprising thing is, how it can support the temperature to which it is exposed in the situations it always frequents amongst the burning sandstone rocks, the mercury there during the heat of the day being frequently at 130 degrees. I have never seen these animals in the plains or lowlands, and believe that they frequent mountains alone.

"The new species of dog differs totally from the Dingo or *Canis Australiensis*. Its colour is the same as that of the Australian dog, in parts, however, having a blackish tinge. The muzzle is narrow, long, thin, and tapers much, resembling that of a greyhound, whilst in general form it approaches the English lurcher. I cannot state that I ever saw one wild, or unless in the vicinity of natives, in company with whom they were generally observed in a domestic state. On the other hand the *Canis Australiensis* was common in some parts in a state of nature. We heard them repeatedly howling during the night, and many portions of dead animals were carried off by them.

"I saw but two flying squirrels, and know not to which species of *Petaurista* they are to be referred.

"Both mice and rats are common, the former precisely resembling in appearance the English field-mouse.

"I have to record the remarkable fact of the existence, in these parts, of a large quadruped with a divided hoof: this animal I have never seen, but twice came upon its traces. On one occasion I followed its track for above a mile and a-half, and at last altogether lost it in rocky ground. The footmarks exceeded in size those of a buffalo, and it was apparently much larger, for, where it had passed through brushwood, shrubs of considerable size in its way had been broken down, and from the openings there left, I could form some comparative estimate of its bulk."

"I cannot assert that the number of genera and species is at all proportionate to that of individual birds—the contrary is probably the real case. The birds of this country possess, in many instances, an excessively beautiful plumage. The beginning of the month of February, or the end of January, is the season in which the birds in these parts pair. In the beginning of March I found many nests with eggs in them; and in the end of that month eggs, nearly hatched, were observed in most of the nests, as well as young birds occasionally.

"Of rapacious birds I saw but four kinds, but these are by no means common. The first species was a very large bird, of a dark colour (*Aquila fucosa,* Cuv.), in size, appearance, and flight closely resembling the golden eagle. They appeared to me always to frequent the shores, for I never saw them further inland than a mile from the sea. The second species was a sort of hawk (*Haliaetus*

leucosternus, Gould) * rather larger than the sparrow-hawk, of a light cinnamon colour, with a perfectly white head. They also frequent the shores. The third species was a Peregrine falcon (*Falco melanogenys*, Gould),† which is nearly allied to that of Europe. The fourth was the *Athene Boobook*.‡ The only difference I could observe between the male and female is, that the female is rather larger than the male, and her colours somewhat lighter. These birds inhabit the whole of that part of North-Western Australia lying between the Prince Regent and Glenelg Rivers. They feed on insects, reptiles, and birds of the smaller kind. I have always found them seated in holes in the rocks, or in shady dells, and have never seen them fly in the day-time unless compelled by fear; they are very stupid when disturbed, and in flight and manner closely resemble the common English owl."

"On March 25 we saw two large white and black birds, more like pelicans than any other kind I am acquainted with. They had webbed feet, and the colour and form of their body resembled that of the pelican, but the head and beak were very different. Upon describing them to Mr. Gould, he informed me that they were most probably of the rare species *Anas semipalmata*."§

"A very curious sort of nest was frequently found, not only along the seashore, but in some instances at a distance of six or seven miles from it. This nest, which is figured, Mr. Gould informed me is the "run" or playing ground of the bird he has named *Chlamydera nuchalis*. These nests were formed of dead grass, and parts of bushes, sunk a slight depth into two parallel furrows, in sandy soil, and then nicely arched above. But the most remarkable fact connected with them was, that they were always full of broken shells, large heaps of which protruded from each extremity of the nest—these were invariably sea-shells. In one instance, in the nest most remote from the sea that we discovered, one of the men of the party found, and brought to me, the stone of some fruit which had evidently been rolled in the sea; these stones he found lying in a heap in the nest.

"I have seen no emus in North-Western Australia, but on two occasions their tracks were impressed in the mud on some plains lying on the banks of the Glenelg River; and Mr. Dring of H.M.S. "Beagle," informed me that on the Fitzroy River he several times saw traces of them, and on one occasion when he was in the bush, two of them passed within a few yards of him."

"The *Cuculus phasianus* ‖ or Pheasant Cuckoo were abundant in some parts. This bird, in colour, in length of tail, in its size, and general appearance so closely resembles the hen pheasant of

* Haliastur indus, Bodd.
† Rhynchodon peregrinus, Tunst.
‡ Spiloglaux novaeseelandiae, Gmelin
§ Pied Goose (Anseranas semipalmata, Lath.).
‖ Polophilus phasianinus, Lath.

England, that when it is on the wing, it is almost impossible to tell the difference; its habits and food are also identical with that of the English pheasant,—the chief point of distinction is that its toes point two before and two behind, in the same manner as those of a parrot; but what is very remarkable about this bird is, that although like the other Scansores, it delights in climbing and running up trees, it is equally fond of running along the ground in the manner a pheasant does. On Dec 21st I found plenty of these birds in a cover of long dry grass and bushes about half my height; as I beat this cover, the pheasants, with their whirring noise, rose on all sides of me."

In the valleys clothed with tropical vegetation "cockatoos soared, with hoarse screams, above us, many coloured parrakeets darted away, filling the woods with their playful cries, and the large white pigeons,* which feed on the wild nutmegs, cooed loudly to their mates, and battered the boughs with their wing as they flew away."

Both white and black cockatoos were met with, and on the rivers "we saw several sorts of cranes, principally *Ardea antigone*† and *Ardea scolopacea*."

"No alligators were seen by the land party, in any of the rivers, but the crew of the schooner saw one in Hanover Bay. I can, however, safely assert from my own experience, that they are by no means numerous upon this coast. Turtles were abundant on the coast, and a long-necked freshwater tortoise was found inland." In the Glenelg River, where it was quite fresh, a large shoal of porpoises was observed.

On March 23 "we fell in with a specimen of the remarkable frilled lizard (*Chlamydosaurus kingii*); this animal measures about twenty-four inches from the tip of the nose to the point of its tail, and lives principally in trees, although it can run very swiftly along the ground: when not provoked or disturbed it moves quietly about, with its frill lying back in plaits upon the body; but it is very irascible, and directly it is frightened, elevates the ruff or frill, and makes for a tree, where, if overtaken, it throws itself upon its stern, raising its head and chest as high as it can upon the forelegs, then doubling its tail underneath the body, and displaying a very formidable set of teeth, from the concavity of its large frill, it boldly faces any opponent, biting fiercely whatever is presented to it, and even venturing so far in its rage as to fairly make a fierce charge at its enemy. We repeatedly tried the courage of this lizard, and it certainly fought bravely whenever attacked. From the animal making so much use of this frill, as a covering and means of defence for its body, this is most probably one of the uses to which Nature intended the appendage should be applied."

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* Nutmeg-Pigeon (Myristicivora bicolor, Scop.)

† Crane or Native Companion (Mathewsia rubicunda, Perry).

On March 7 we saw "a very large Iguana which ran up a tree. This brute was of a beautiful green colour, and five or six feet long; it sat on the tree, making a noise somewhat like a snake."

On March 17 a curious, moving, mis-shapen object proved to be "a small kangaroo enveloped in the folds of a large snake, a species of Boa. It was of a brownish-yellow colour, and eight feet six inches long."

At the mouth of the river we often "watched a strange species of fish (genus *Chironectes*, Cuv.). These little animals are provided with arms, at least with members shaped like such as far as the elbow, but the lower part resembles a fin; they are amphibious, living equally well on the mud or in the water; in moving in the mud, they walk, as it were, on their elbows, and the lower arm or fin then projects like a great splay foot; but in swimming, the whole of this apparatus is used as a fin. They have also the property of being able to bury themselves almost instantaneously in the soft mud when disturbed. The uncouth gambols and leaps of these anomalous creatures were very singular.

"Another remarkable fish was a species of mullet, which being left by the retreat of the high tides in the pools was obliged to change its element from salt to fresh water, which by a very remarkable habit it appeared to do without suffering any inconvenience. The natural hue of this fish was a very pale red, but when they had been for some time in the fresh water this reddish tinge became much deeper, and when of this colour, I have found them in streams a considerable distance from the sea."

"The shores were thickly wooded with mangroves, from the boughs of which depended in clusters small but well-flavoured oysters." Ponds frequently "contained abundance of large fresh-water mussels (*unios*)."

"To sleep after sunrise was impossible on account of the number of flies which kept buzzing about the face. To open our mouths was dangerous,—in they flew, and mysteriously disappeared, to be rapidly ejected again in a violent fit of coughing; and into the eyes, when unclosed they soon found their way, and by inserting the proboscis, and sucking, speedily made them sore; neither were the nostrils safe from their attacks, which were made simultaneously on all points, and in multitudes."

"Whenever a tree was shaken, numbers of a large green sort of ant fell from the boughs on the unhappy trespasser, and making the best of their way to the back of his neck, gave warning by a series of most painful bites, that he was encroaching on their domain."

At night mosquitoes were troublesome, and brilliant fire-flies flitted amongst the bushes. "The gigantic ant-hills, so much spoken of by former visitors of these shores," were commonly met with.

Whilst Grey and his party were endeavouring to explore inland from Hanover Bay, H.M.S. "Beagle," under Capt. Wickham, was engaged in exploring part of the coastline of the Kimberley District.

1838. Writing of Roebuck Bay, on January 17, 1838, Stokes[9] mentions that "Vampyres * of a very large kind, were here met with, the furthest south we had seen them." "Several very large black martins, with white or grey heads (Noddies) † were hovering over the ship this morning; and many flights of small white tern, and a bird, commonly called the Razor-Bill, passed and repassed the ship every morning and evening, flying from the bay to seaward, and returning at sunset. Two water-snakes were shot alongside the ship during the day; the largest measured four feet, and was of a dirty yellow colour. A good sized fish was taken from the stomach of one of them. Their fangs were particularly long, and very much flattened, having no cutting edge whatever. Some turtle also passed the ship to-day, and a day or two afterwards we were fortunate enough to shoot one, which weighed 160 pounds."

From the end of January till the beginning of April, the "Beagle" was engaged in surveying King Sound and the Fitzroy River, which flows into it. Stokes makes the following notes on the animals met with in this district:—"It is not a country naturally very abundant in game of any kind, except kangaroos, which are numerous, but so harassed by the natives as to be of course extremely shy of the approach of man. However, Mr. Bynoe succeeded in shooting one, which possessed the singular appendage of a nail, like that on a man's little finger, attached to the tail.

The dimensions and height of this singular animal were as follows:—Length of body, from tip of nose, 22 inches; Length of tail, from stump to tip, 24½ inches; weight, 13 pounds.

This animal has been classed by Mr. Gould as *Macropus unguifer*,‡ and is now deposited in the British Museum. "We also saw some very large red or cinnamon-coloured kangaroos, but never got near enough to secure one. They were apparently identical with a new race, of which I afterwards procured a specimen at Barrow's Island (*Osphranter Isabellinus*, Gould).§

On March 23rd, "We observed several of the rock-kangaroo, bounding over huge blocks of coarse sandstone, with their long, bushy tails, swinging high in the air, as if in defiance of pursuit."

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* Flying-foxes (Pteropus sp.).

† Noddy Terns (Anous stolidus, Linn).

‡ Nail-tailed Wallaby (Onychogale unguifera, Gould).

§ Macropus robustus isabellinus, Gould.

9 Stokes, J. L.: Discoveries in Australia by H.M.S. Beagle, 1837–43. London, 1846.

On February 10th, natives were seen "accompanied by a black dog. The only instance in which, before or since, we observed the existence of a dog of that colour in this vast country. Captain King mentions that he saw one in this neighbourhood during his visit in 1821."

Two emus were seen in a plain, by the Fitzroy River. A bronze-winged pigeon was met with, as well as "some rather small pigeons (*Petrophila albipennis*, Gould)* of a dark brown colour, marked with a white patch on the wings," some of which were shot. "They made a whirring sound in flight, like the partridge, and appeared to haunt the rocks; a habit which all subsequent observations confirmed.

"We were lucky enough to shoot several quails of apparently quite a new species. In one particular, they differed from the members of the genus Coturnix, in having no hind toe." On Valentine Island there were "quail large and small, which were numerous." The plain of the Fitzroy River was "also a favourite resort of quail."

"One day, when I had penetrated some considerable distance into the bush, I saw a large bustard,† but was unable to get a shot at him. I thought at the time that he bore a strong resemblance to the wild turkey of the colonists in the southern part of the continent."

"Among the ornithological specimens obtained was one of the curlew tribe,‡ greatly resembling an ibis, and remarkable for its size. It measured from the extremity of the bill to the tip of the toe, 27½ inches, and weighed 1lb. 14½oz. The colour, with the exception of the belly and legs, which were of a dirty white, slightly mottled, very much resembled that of the common English wild duck." At the mouth of the Fitzroy River, "the circling flight of the ever wary curlew and the shrill cry of the plover alone vouched for the presence of animal life."

On February 6, "we flushed a white bird, or at least nearly so, with a black ring round the neck, and a bill, crooked, like the ibis, which bird indeed, except in colour, it more resembles than any I have ever seen. (Since ascertained to be an Ibis—the *Threskiornis strictipennis*)."§

On the Fitzroy "we saw white and black cockatoos," and on March 25, in King Sound. "a large flock of white cockatoos screamed violently, as if wishing to dispute our landing."

On Valentine Island, and on the mainland, on March 21, we flushed several Pheasant-cuckoos (*Centropus phasianellus*).‖ On "a flat, clothed with rich grass, we found one of their nests on

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* Petrophassa albipennis, Gould.

† Bustard or Wild Turkey (Austrotis australis, Gray).

‡ Australian Curlew (Numenius cyanopus, Vieill.).

§ White Ibis (Threskiornis molucca, Cuvier).

‖ Pheasant Cuckoo (Polophilus phasianinus, Lath.).

the ground, containing four eggs; in size and colour, they resembled those of the domestic pigeon. The nimble manner in which these birds hop along the branches of trees, with their long tails whisking behind, gives them, at the first glance, more the appearance of monkeys than birds."

On Valentine Island "several birds, not unlike the so-called crow of the Swan River colonists, were seen," and on the Fitzroy River "we saw a variety of Finches." Several specimens of rare birds were obtained by Messrs. Bynoe and Dring, all of which are now figured by Mr. Gould in his Birds of Australia."

"Guanas and lizards were plentiful in this neighbourhood, and some of the latter, in particular, were most brilliant in colour. They ran down the tall trees, in which they seem to pass a great portion of their lives, at our approach, with a most marvellous rapidity, and darting along the ground, were soon in safety." On March 13th, on the Fitzroy, "we saw an alligator slide his unwieldly carcase from the soft mud-bank, upon which he had been "lazily" reclining, into one of the creeks."

In King Sound "we had one most successful haul with the seine, which amply supplied us with fresh fish for that and the two following days; the greater part were a kind of large mullet, the largest weighed six pounds five ounces, and measured twenty-five inches in length." "The fishing over the ship's side was not less successful than hauling the seine, though quite a different kind of fish was taken, to reward the labour of the salt-water Waltonians, who devoted themselves to it. They generally secured (at slack water) a large fish, in shape like a bream, and with long projecting teeth."

On the land "the flies are at you all day, crawling into your eyes, up your nostrils, and down your throat, with the most irresistible perseverance, and no sooner do they, from sheer exhaustion, or the loss of daylight, give up the attack, than they are relieved by the mosquitoes, who completely exhaust the patience which their predecessors have so severely tried." "What, perhaps, most attracted our attention, was the surprising size of the ant-hills, or nests. I measured one, the height of which was 13 feet, and width at the base 7 feet; from whence it tapered gradually to the apex. They are composed of a pale red earth; but how it is sufficiently tempered I am unable to state; certain is it that it has almost the consistence of mortar, and will bear the tread of a man upon the top."

While the "Beagle" was in Collier Bay, in April, 1838, Stokes records that "several rock kangaroos were seen on the heights." "Two birds (*Haematopus picatus*), rare on this part of the coast, were shot; they were of a smaller kind than any I had before seen, and different from them in plumage, being without the white collar round the neck."

On April 10th "we came within the searching glance of a hungry eagle, which soaring over our heads for some time, at length swooped within range of our guns, when he paid for his curiosity with the loss of his life. This was the only rapacious bird we saw in Collier Bay, and appears to be of the species *Falco leucogaster,* Latham. (Figured in Mr. Gould's work on the Birds of Australia as *Ichthyiaetus leucogaster.*) * On examination, the stomach contained fish and part of a small snake, and from what I have since observed this bird frequents the sea coast. Their nests are very large, built on bare spots in the shape of a pyramid; some of them measuring three feet in diameter, and six high."

"The scenery in some of the dells we crossed was very picturesque, and quite alive with birds and insects; flights of many-coloured parrokeets swept by with a rapidity that resembled the rushing sound of a passing gust of wind."

On Feb. 28, 1838, at a meeting of the Zoological Society,[25] "Mr. Gould exhibited two species of the genus *Ptilotis,*" one of which, *P. ornata,* n. sp., † was from the Swan River.

On June 4, 1838, at a meeting of the Entomological Society,[26] Mr. C. C. Babington read a paper on the *Dytiscidae* collected by Darwin, amongst which was one from King George's Sound, described as new under the name of *Hydroporus darwinii.*

In a "Catalogue of the Slender-tongued Saurians,[27] published by J. E. Gray in 1838, a new species belonging to the Family *Monitoridae* from Shark's Bay, W.A., is described as *Odatria punctata.* ‡

On July 16, 1838, G. F. Moore records in his diary a story told to Sir James Stirling by an American whaler, which was at Bunbury during the Governor's visit there. He says:—"They have got a fine Yankee story to tell about a shark 30 feet long, which got entangled in the buoy rope attached to the anchor, and by its exertions actually weighed it and let the ship go adrift, to their no small consternation, until they discovered the cause. Many people saw the occurrence. The shark was eventually caught, and 37 gallons of oil procured from its liver."

In December he notes: "Coming up from Perth the other day I saw some emus near the road. Stooping on the horse, and keeping some bushes between me and them, I rode up within twenty yards before they took the alarm. It was a mother and two young ones. The poor mother became anxious and troubled, and fussed about like a hen with chicks, running and turning and leading them off."

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* White-bellied Sea-eagle (Cuncuma leucogaster, Gmelin).

† Yellow-plumed Honey-eater (Lichenostomus ornatus, Gould).

‡ Varanus punctatus, Gray.

25 Proc. Zool. Soc., London, 1838.

26 Trans. Ent. Soc., London, III., 1841–1843.

27 Annals of Nat. Hist., Vol. I., 1838.

"Sitting the other night at an evening party in Perth, a little kitten came playing in the room. I felt something thrown against my leg several times, but did not pay much attention; at last, on a repetition, I looked more closely, and found it a large scorpion which the kitten was tossing about so unconcernedly."

1839.—During January, 1839, Lieut. Grey[24] made an expedition to look for a settler who had lost his way in proceeding from the Williams to Bunbury. He ultimately reached Bunbury in safety. In the country about the Williams and the Harvey, Grey saw kangaroos and kangaroo-rats. "The most usual disturbers of these wooded solitudes were the black cockatoos."

On February 17, 1839, Grey left Fremantle in a whaler to explore Sharks Bay, and, if possible, to make a journey inland. The party disembarked on Bernier Island, where the whaler left them with three boats and ample stores. Three days later one of their boats was smashed to pieces in a storm. They visited Dorre Island, and then crossed to the mainland where they discovered the mouth of the Gascoyne River, but constant storms prevented much exploration. On returning to Bernier Island a month later they found that during their absence a gale had blown away their depôt of provisions. There was nothing for it but to endeavour to make their way back to Fremantle in the two boats with the remnants of their provisions, but after leaving the Bay by the South Passage, both boats were smashed in landing at Gantheaume Bay. From this point they travelled on foot to Perth, which was reached, after they had endured great hardship, by all the members of the party except a youth named Smith, who died of exhaustion.

Grey records the following observations on animals seen at Sharks Bay. On Bernier Island "the only animals we saw were kangaroo-rats, one pigeon, one small land-, and many sea-birds, a few lizards, mosquitoes, ants, crabs, oysters and turtle." On Dorre Island they met with "a small species of kangaroo-rat" and a cormorant and found turtles' eggs.

On the shores of the mainland they saw tracks of native-dogs and emus, and at the mouth of the Gascoyne a sandy point was "covered with pelicans and wild fowl." During their walk up the bed of the river they "saw many cockatoos."

As they sailed along the coast the flats beneath them "were covered with vivid coloured shells of many genera, some of which were of a large size; strange-looking fish of a variety of kinds were also sporting about, more particularly large sharks of a new species, and sting-rays." All along the shoals we met with abundance of shell and other fish, and the pearl oyster was very abundant; indeed the shell-fish along these banks were more numerous

24 Grey, G.: Journals of two Expeditions of Discovery in North-West and Western Australia, during the years 1837, 8, and 9, London, 1841.

and varied than I had ever before found them. I saw but few shells which I recognised as belonging to the southern portions of Australia, whilst many were identical with those which occur to the north-west."

There were "armies of crabs" on the mangrove-flats, and "land-crabs" among the sand-hills, and they "were completely blackened from the numbers of mosquitoes that covered them."

On the journey from Gantheaume Bay to Perth overland, Grey records seeing kangaroos, native dogs, emus, wild turkeys, wild swans, pigeons, white cockatoos ("of a species new to me"), black cockatoos, parrakeets, hawks and crows, and freshwater mussels (*Unio*).

On June 3, 1839, at a meeting of the Entomological Society,[26] Mr. W. Bainbridge described a number of Australian beetles of the genus *Bolboceras* in the collection of the Rev. F. W. Hope. Amongst them were six new species from the Swan River, three of which had been collected by Capt. Roe.

On Aug. 3 Moore writes that, in company with Lieut. Grey and Mr. Leake, he went to visit the waterfalls (Lesmurdie ?). "We found a number of land shells about the rocks near the face of the cliff. These shells are rare in the colony. I do not know that I have seen any before."

On Nov. 11 he records that on a short excursion to the northwards, "whilst we were at one of the lakes a native joined us who had a snake 7 feet 4 inches long, which he had killed. I bought the skin from him; he ate the body."

On Nov. 30 he writes: "I learned to-day the way to procure the crayfish as the natives do. In a swamp you see a hole with earth thrown up, much in the way that you see it with the large worms on the sea-shore. You must put in your arm and scrape with your hand till you find it, perhaps two feet down. It is like a small, very small lobster, and can bite very smartly."

In a second part of J. E. Gray's Catalogue of the Slender-tongued Saurians,[28] published in 1839, a lizard belonging to the *Scincidae* from King George's Sound is described as *Chiamela durancellii, Cocteau* (?).

During 1839 the Rev. F. W. Hope published[29] a figure and description of a longicorn beetle sent by Capt. Roe from Swan River and named it *Lamia boisduvalii*.

1840. On Jan. 14, 1840, H.M.S. "Beagle"[9] was fifty miles North-West of "the north point of Sharks Bay" at noon. On the same evening, Stokes records, they "saw a herd of sperm whales." During the same month the colonial schooner "Champion" was sent

9 Stokes, J. L.: Discoveries in Australia by H.M.S. Beagle, 1837–43. London, 1846.
26 Trans. Ent. Soc., London, III., 1841–1843.
28 Annals of Nat. Hist., II., 1839.
29 Mag. of Nat. Hist., New Series, Vol. III., 1839.

to examine the country about what was subsequently known as Champion Bay, and also visited Houtman's Abrolhos Islands. Mr. G. F. Moore, who accompanied the expedition, wrote:[24] "Nothing can exceed the beauty of the different sorts of coral, as seen under the clear, smooth water. We broke off many specimens of the branch or tree coral, which seemed to be in full vigour of life and activity. In passing from island to island, we had many opportunities of observing the different formation and shape of several species of coral; some stood in masses of the brainstone and cockscomb coral, some like petrified sponge, some like fans, some again of the branch coral interlaced and intertwined in every direction; again, some broad flat masses lying layer over layer, like huge sea lichens; again, many presented the appearance of a fungus or great sea-mushroom, with a broad-spreading head springing from a small thick base. These islets appear to be a favourite resort of seals, many of which we saw, but of the sort called hair seals.* Birds were abundant on most of the isles, and on two of them were hawks' nests, raised to the height of four feet by an accumulation of stick, stones, and shells. Rock oysters, of a large size and delicious flavour, were found in great abundance."

In his diary Mr. Moore adds: "One day we had very nice soup made from the *haliotis* or *Aures marinae*. I was rather disappointed at not finding turtle. To my surprise we found a great number of an animal called wallaby †—about the size of a hare. How did they get there? It is 45 miles from land."

On March 9 he mentions, "One of the Messrs. Burges came here to breakfast this morning; he comes from near York, where they are now settled. He tells me he killed 103 emus since he went over there, about three years ago."

During April and May, 1840, the "Beagle" was engaged in surveying the Houtman's Abrolhos Islands. Stokes[9] mentions that a few hair seals were met with on Pelsart Island and Rat Island; the latter island was named "from the quantity of that vermin with which it was infested."

"The northern end of West Wallaby Island is a level, stony flat with patches of bushes large enough to serve as fuel here and there, all full of a new species of wallaby, which, being plentiful on both the large islands, suggested their name. The reader will obtain a good idea of the numbers in which these animals were found when I state that on one day, within four hours, I shot 36, and that between three guns we killed 76, averaging in weight about seven pounds each. On North Island there was not a single

* White-necked Hair-seal (Eumetopias albicollis, Peron).

† Dama Wallaby (Macropus eugenii, Desm.)

9 Stokes, J. L.: Discoveries in Australia by H.M.S. Beagle, 1837–43. London, 1846.

24 Grey, G.: Journals of two expeditions of discovery in North-West and Wesfern Australia, during the years 1837, 8 and 9, London, 1841.

wallaby. The species has been described, from a specimen we obtained, as *Halmaturus Houtmanni*; it is distinct from *Halmaturus Derbyanus,* found on most of the islands on the southern parts of the continent."

"The soil of Rat Island, and the south-west side of West Wallaby Island, is filled with burrows of the sooty petrel or mutton bird,* so that it forms rather troublesome walking. There was a flat in the centre of North Island, covered with coarse grass, where a great many quails were flushed, affording good sport. Three small flat islands just between the Wallaby Islands were called Pigeon Islands, the common bronze-winged pigeon† being found there in great numbers. It may be remarked that the birds met with on Houtman's Abrolhos, with the exception of one, resembling in shape and colour a small quail (*Hemipodius scintillans*, Gould),‡ were known and common on the mainland. The aquatic species were also familiar to us, but the habit of one kind, of a sooty-black colour, generally called noddies,§ was quite new—that of building their nests, which are constructed of seaweed and contain only one egg, in trees."

"On Rat Island we saw numbers of a very pretty lizard [figured in the appendix by J. E. Gray as *Silubosaurus stokesii*,‖ new sp., though the only habitat there given is Australia], with its tail covered with spines. Several of them were brought away alive. Lieut. Emery was so fortunate as to bring one alive to England, in 1841. He writes: 'The Abrolhos lizard is very docile, and knows Mrs. Emery quite well, and will eat and drink out of her hand, but is timid with strangers. Its habits are rather torpid, but it becomes active when in the sun or before the fire. It eats so very little that a piece of sponge cake about the size of a small bean will satisfy it for three or four weeks. It changes its skin twice a year.'"

"There were not many varieties of fish about the islands, the most abundant being snappers. A bank seven miles east of the Easter Group we called Snapper Bank, from the immense quantity of that fish which we found on it. In half an hour we caught more than we could cure."

"A rich kind of rock oyster was found at low water at Pelsart Island."

On June 7, 1840, G. F. Moore notes in his diary: "Mr. Preiss, the naturalist, has found over the hills a species of jerboa. I had often heard the natives speak of it by the name of *daddaar,* as abounding in the interior. Its shape is like a kangaroo, but more delicate and graceful, and scarcely as large as a squirrel."¶

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* Wedge-tailed Petrel (Thyellodroma pacifica, Gmel).
† Brush Bronze-wing (Cosmopelia elegans, Temm.).
‡ Painted Quail (Entygodes varius, Lath).
§ Lesser Noddy (Megalopterus tenuirostris, Temm.).
‖ Egernia stokesi, Gray.
¶ Notomys mitchelli, Ogilby.

On June 9, 1840, the "Beagle" visited Depuch Island, and Stokes recorded: "Although Depuch Island had been visited before, there still remained something quite new to reward the diligent search that was made after objects of natural history, namely, a small kind of kangaroo, a land bird, and a shell, a species of *Helix*. The bird was shot by Mr. Bynoe; it was a finch (*Emblema picta*, Gould) and beautifully marked with stripes of crimson down the breast on a black ground with white spots; the throat, and a patch round the stump of the tail, were crimson. It is remarkable that all the beauty and brilliancy of colour in this bird is underneath, the back being of a common earthy brown.

"The kangaroo I had myself the good fortune to knock over on the summit of the island. The colours of this specimen, the prettiest we had seen, were a dark grey, with a large angular patch of white down the side, extending from the top of the shoulders nearly to the hips. Down the centre of the back ran a streak of black, which was also the colour of the extremity of its slightly bushy tail. The face and belly were likewise darker than other parts of the body, and the feet were black and well cushioned, giving it a firm hold of the rocks over which it bounded with surprising agility, though it never ran very far, always popping into the cavities caused by the loose manner in which the blocks forming the island are thrown together. (Mr. Gould has figured an animal very like this I have described as *Petrogale lateralis*, from a specimen he some time afterwards got from Western Australia, but he has not noticed the beautiful kangaroo of Depuch Island)."

Whilst the "Beagle" was at the Turtle Islands "in the course of four hours thirty green turtles* were brought on board; one of which, and not the laregst, weighed 385 pounds. A small hawk's bill,† the first and only one seen, was also taken. On this part of the coast grows a peculiar, small kind of weed, on which they feed; it was first seen near Depuch Island."

On June 23, 1840, at a meeting of the Zoological Society of London, the Rev. F. W. Hope[30 & 31] read a paper entitled "Observations on the Stenochoridae (Longicorns) of New Holland." Nine species, belonging to five genera, are recorded from Swan River, all but one of them being described as new. Seven of the species had been sent by Captain Roe.

On Aug. 25, 1840, at a meeting of the Zoological Society[30] "specimens were exhibited of five new species of kangaroo, forming part of the collection made by Mr. Gould, who had just returned from Australia, after an absence of two years and a-half in the investigation of the habits and economy of the animals of that con-

* Chelonia mydas, Linn.

† Caretta caretta, Linn.

30 Proc. Zool. Soc., London, 1840

31 Trans. Zool. Soc., Vol. III., 1849.

tinent." Among them were *Macropus unguifer*, n. sp.* from the North-West coast of Australia and *Macropus lunatus*, n. sp.,† from the West coast of Australia.

"Mr. Gould also exhibited a remarkable spiny lizard, allied to the Agamas,‡ which he had procured from Swan River."

On Aug. 27, the "Beagle" was at Delambre Island, near Bedout Island, where "a few turtle were taken of a different kind from any we had seen before, and apparently a cross between the Hawk's Bill and the Green Turtle; several nests were also found, in one of which were 138 eggs."

Stokes further records "near Barrow Island, on our passage, I shot (from the quarter-boat) the largest sea-snake ever killed. It is figured and described in the Appendix by Mr. J. E. Gray (who only gives the locality as "Australia), as *Hydrus major*, and measured eight feet one inch in length by three inches broad; the colour was a dark yellow; several smaller ones, striped brown and white, were also seen."

"We found a new kind of kangaroo and wallaby on Barrow Island; but the only specimen obtained of the former was destroyed through the neglect of the person in whose charge it was left. It was a buck, weighing fifty pounds, of a cinnamon colour on the back and a dirty white on the belly; the hair was fine and long; the head of a peculiar shape, resembling a dog's, with a very blunt nose; the forearms were very short; the hind feet cushioned like those inhabiting rocky ground. The does appeared to be much lighter, but all were very wary and scarce. From the number of red sandhills, too, scattered over the island, they were difficult to be seen at a distance. From our description of this specimen it has been named *Osphranter isabellinus*.§ With the wallaby‖ we were more fortunate, Mr. Bynoe and myself succeeded in knocking over four, weighing from five to eight pounds; they also had blunt noses, and were of a light brown colour, quite different from those on the Abrolhos.

"Two iguanas measuring seven feet in length, and nearly black, striped slightly with white, were also killed here." "On leaving we brought away with us seven tons of turtle from the abundant supplies the shores afforded."

There were plenty of wallaby on the larger of the Montebello Islands. "On Tremouille Island, the wallaby, which were very numerous, must have got their supply of moisture from the copious dews. They were found lying close in the wiry prickle grass, allowing us to kick them out, when they went off at speed, affording excellent sport, quite equal to any rabbit shooting; among three guns we managed, in a couple of hours, to bag nearly twenty. It

* Onychogale unguifera, Gould.
† Onychogale lunata, Gould.
‡ Mountain Devil (Moloch horridus, Gray).
§ Macropus robustus isabellinus, Gould.
‖ Lagorchestes conspicillatus, Gould.

was quite a new kind of wallaby, and has been classed, from a specimen we brought away, as *Lagorchestes conspicillata*. It had a blunt nose, similar to those at Barrow Island, and was about the same size, though its colour was lighter, and it had a back exactly like a European hare. The tail tapered away like a rat's, and the flesh was by no means good to eat, tasting very strong; this was the only instance in which we found wallaby at all unpalatable."

On October 13, 1840, at a meeting of the Zoological Society,[30] "Mr. Gould stated that he had received from Swan River a bird having habits similar to those of the Brush Turkey of New South Wales and a similar mode of nidification, but differing in inhabiting the open sandy plains and in forming the mound for the reception of the eggs of sand, dead grass, and boughs, depending as much upon the sun's rays as upon the heat produced by decomposition to develop the young. Mr. Gould added, that a most interesting note, detailing these facts, accompanied these specimens, and that an equally important sketch of its range, etc., had been furnished him by Capt. Grey, who had just returned from the North-West coast of Australia. Mr. Gould characterised it as a new genus, under the name of *Leipoa*, signifying the deserter of its eggs. The specific term of *ocellata* was suggested by the ocellated character of many of the spots with which its body is adorned.

Mr. Gould next characterised two new birds :—

Cracticus argenteus *—N.W. coast of Australia (collected by Capt. Grey), and

Amadina pectoralis †—N.W. coast of Australia (collected by Mr. Dring of H.M.S. "Beagle").

Mr. Gould next characterised two new species of kangaroo :—

Macropus (*Halmaturus*) *manicatus* ‡—Swan River.

Macropus (*Petrogale*) *brachyotis* §—Hanover Bay, N.W. coast of Australia (collected by Capt. Grey).

In November the "Beagle" called at Albany on her way back to Sydney. Stokes wrote that "in this neighbourhood the kangaroo is found in great abundance. I am certain there could scarcely have been less than a hundred in a herd. It was curious to observe them hopping along over the grass or underneath the trees, with the large males bringing up the rear of a certain number of does." "We heard the kangaroos thumping the ground all night, as they hopped along round our bivouac, the heavier fall of the male being plainly distinguishable."

On Nov. 10, G. F. Moore mentions that he had been over to Rottnest to examine and report upon the aboriginal prisoners; one of them had been poisoned by eating a "blowfish" and died.

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* Bulestes torquatus, Lath.
† Heteromunia pectoralis, Gould.
‡ Macropus irma, Jourd.
§ Petrogale brachyotis, Gould.
30 Proc. Zool. Soc., London, 1840.

At a meeting of the Zoological Society [30] on November 10, Mr. Gould exhibited a small Rodent, supposed to be identical with the *Dipus mitchellii*,* procured from Western Australia.

At this meeting, and those of November 24, and December 8, he also exhibited fifty new species of birds from his Australian collection, amongst which were the following from Western Australia :—

Euphema splendida, [a] *Euphema petrophila*, [b] *Climacteris rufa*, [c] *Ocypterus personatus*, [d] (also from South Australia), *Ptilotis plumulus*, [e] *Myzantha obscura*, [f] *Ptilotis sonorus* [g] (also from South Australia), *Glyciphila albifrons*, [h] *Meliphaga mystacalis*, [i] *Falco hypoleucos*, *Podargus brachypterus*, [j] (or *macrorhynchus*), (from Swan River), *Colluricincla brunnea* (from the N.W. coast), *Colluricincla rufiventris* (from Swan River), *Zosterops chloronotus*, [k] *Myzomela pectoralis*, [l] (from the N.W. coast), *Dasyornis longirostris*,[m] *Piezorhynchus nitidus*,[n] (from the N.W. coast), collected by Mr. Dring, Surgeon, of H.M.S. Beagle, *Acanthiza inornata* (from Swan River), *Microeca assimilis*,[o] (from Swan River), *Myiagra latirostris* (from the N.W. coast, collected by Mr. Dring), *Petrophassa albipennis* (from the N.W. coast), *Rhipidura isura*,[p] (from the N.W. coast, collected by Capt. Grey, and by Mr. Dring), *Psilopus culicivorus*,[q] *Licmetis pastinator*,[r] *Porphyrio bellus*, *Anas naevosa*.[s]

At a meeting on December 8, Gould also exhibited a new species of *Hypsiprymnus* from Swan River, which he characterized under the name of H. *grayi*.[t]

In the Annals of Natural History [32] for 1840, Edward Newman published an article on Australian Longicorns, in which *Scleocantha pilosicollis* (Hope) is recorded from Swan River.

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* Notomys mitchelli, Ogilby.

a Neophema splendida, Gould.
b Neonanodes petrophilus, Gould
c Whitlocka rufa, Gould.
d Campbellornis personatus, Gould.
e Lichenostomus plumulus, Gould.
f Myzantha flavigula, Gould.
g Meliphaga sonora, Gould.
h Gliciphila albifrons, Gould.
i Meliornis niger, Bechst.
j Podargus strigoides, Lath.
k Zosterops gouldi, Bonap.
l Cissomela pectoralis, Gould.
m Sphenura longirostris, Gould.
n P. alecto, Temm.
o M. fascinans, Lath.
p Setosura setosa, Q. & G.
q Ethelornis culicivorus, Gould.
r L. tenuirostris, Kuhl.
s Stictonetta naevosa, Gould.
t Bettongia lesueuri grayi, Gould.

30 Proc. Zool. Soc., London, 1840.

32 Ann. Mag. Nat. Hist., Vol. V., 1840.

THE GEOLOGICAL RESULTS OF AN EXPEDITION TO THE SOUTH AUSTRALIAN BORDER, AND SOME COMPARISONS BETWEEN CENTRAL AND WESTERN AUSTRALIAN GEOLOGY SUGGESTED THEREBY.

BY

H. W. B. Talbot and E. de C. Clarke.*

(With Three Plates and Twelve Figures.)

TABLE OF CONTENTS.

INTRODUCTION.

Between the months of June and December, 1916, we were engaged in a reconnaissance geological survey to the South Australian border in the neighbourhood of lat. 26°, the main object of the expedition being to ascertain the auriferous possibilities of the country near the Warburton Range. The results are fully set out in Bulletin No. 75 of the Geological Survey of Western Australia.

Some part or other of the country which we examined has been explored by W. G. Gosse, Ernest Giles, Forrest, Lindsay (in command of the Elder Exploring Expedition), Carnegie, J. G. Hübbe, H. Russel, R. J. Maurice, and F. H. Hann. A résumé of the labours of these men will be found in the bulletin referred to.

* By permission of the Director of the Geological Survey of Western Australia.

In 1891 the Elder Exploring Expedition, with Victor Streich as geologist, travelled from Central to Western Australia along a course fairly close to that afterwards followed by us, and in 1909 Talbot, much farther to the north, visited Tanami in the Northern Territory, from Hall's Creek in the Kimberleys.*

Since these two expeditions are, so far as we know, the only ones containing professed geologists to publish reports that link up the geology of a part of Western Australia with that of parts of the central regions of the Continent, it appears justifiable to offer a shorter and more generalised account of the results obtained by our expedition than is given in the official bulletin. In this account as contrasted with the bulletin greater stress will be laid on comparisons between Central and Western Australian geology suggested by our own work, by that of Mr. R. A. Farquharson, Petrologist to the Geological Survey of Western Australia, and by that of other geologists.

Our expedition was made in the latter part of an exceptionally good season, and consequently the plant and animal life of the arid country which we traversed was seen at its best. Unfortunately, we could not attempt to collect the many interesting forms, particularly of birds and insects, which were noted. A dried collection of the majority of plants noticed on our outward journey has been submitted to Dr. F. Stoward, of the Department of Agriculture, who has very kindly undertaken to identify the specimens. Also a collection of the fauna (mainly phyllopods) of the waterholes has been handed to Prof. W. J. Dakin, of the University of Western Australia.

Our party, consisting, all told, of six men and sixteen camels, left Laverton on 29th June, 1916, and travelled in a general east-north-east direction to Lilian Creek, in Townsend Range. Here, where there is an apparently permanent supply of water at a very shallow depth, a depot camp was established at which three men and most of the camels were left, while we, with one man, made "flying" trips in various directions in order to map the country topographically and geologically. Unfortunately, this man (J. Johnson) was severely wounded in a night attack made by blacks near Mt. Gosse, close to the South Australian border. The leader (H.W.B.T.) was also wounded, and we were compelled to abandon extended geological work (although another flying trip was made while Johnson was resting in the depot camp), and return to Laverton a month before our time to place the wounded man in the doctor's hands. Another month in the Warburton country would probably have enabled us to arrive at a much more definite and accurate conception of its geology.

A time and compass traverse, checked by frequent observations for latitude, was run from Laverton to the Border, and, when calcu-

* Geol. Surv. of W.A. Bull. No. 39.

lated, was found to close correctly for latitude on the Trigonometrical Station at Mt. Gosse, while easting had been over-estimated by 170 chains which, in a distance of over 500 miles, is an error of less than one-half per cent.

The position, catchment, storage capacity, etc., of the more important rock-holes and other waters seen by us are described in Bulletin No. 75. From this description it will be seen that the "desert" area defined below could only be traversed, even by camels, during or shortly after a fairly good season. In fact, it is probable that had our return been, as was intended, towards the end of November, we should, despite the good autumn rains, have fared badly for water.

We must reiterate our admiration for and indebtedness to the pioneering work of Mr. F. Hann, whose route we followed through the "desert" area.

Three aneroids and two thermometers were regularly read throughout the trip and we were thus enabled to arrive at a fairly reliable series of levels, as far as the South Australian border. For particulars, Bulletin No. 75 must be consulted. We checked our observations on the return journey, and, therefore, though heights determined by this expedition exceed those of the Elder Expedition by two or three hundred feet, we regard ours as more nearly correct.

From the scenic, as from the physiographical and geological view-points, two fairly distinct types of country were recognised along the route. From Laverton to Townsend Range, the country is of the so-called "desert" type, common in the interior of this State. Characteristic of this type are the great expanses of sand-plains and sand-ridges, which are not bare sand wastes, but are covered with "spinifex" (species of Triodia), and dotted with "desert gums" and other eucalypts, so that they have a general resemblance (which does not survive closer acquaintance) to open park-lands. The monotonous and waterless sand-country is occassionally interrupted by breakaways, some of which can be seen clearly at a distance of as much as thirty miles although their elevation above the surrounding country never exceeds 150 feet. Skirting the breakaways, there is usually a loamy flat, perhaps a mile wide, on which fair feed for camels and horses may be expected. On or close to the breakaways are the waterholes and soaks which afford the only surface waters of this region.

Between Townsend Range and the South Australian border, rounded hills and broken ranges take the place of breakaways, and the intervening flats are often formed of rich soil which supports a permanent growth of "scrub" in addition to the "herbage" of good seasons. Sand-plains and ridges occur to a minor extent in this second type of country, which barely exceeds 30 miles in width from north to south, and passes in both directions into "desert."

As more fully explained in Bulletin 75, we estimate that in the section between Townsend Range and the South Australian border (which we have called the Warburton Area) there are three patches, covering in all rather less than a million acres, which compare favourably with the best pastoral areas of the Murchison and Gascoyne, while in the "desert" portion of our course there are enough oases of feed to serve a stock route. Obviously, however, the sinking and equipping of the eighteen or more wells necessary for such a route would involve an expenditure unjustified by the area of pastoral country which is at present known to exist.

PHYSIOGRAPHY.

In Bulletin 75 is a fairly detailed account of the physiographic features of the country under review. The points of most general interest are briefly stated below.

The whole of the country lies on the great plateau of Western Australia, which has in this part an average elevation of between 1,500 and 2,000 feet above sea-level. Jutson * is inclined to regard this plateau as a vast uplifted peneplain. As already mentioned, it is convenient to divide the country into Desert and Hilly Zones.

1. *Desert Zone.*—The outstanding characteristics of this type of country have been mentioned in the introductory remarks.

The general uniformity of level is demonstrated in Plate III., in which the positions of various stations have been projected on to a straight line joining Laverton and Axe Hill. This figure also shows that there is a decided dip in the vicinity of Lake Yeo, and this depression has some bearing on the theories advanced by Prof. Gregory † regarding the former drainage-system of Western Australia.

The desert type of country seen on this expedition is best discussed under two sub-heads Sand-country and Breakaway-country.

Two varieties of Sand-country may be distinguished: plain and hilly. Sand-plains cover most of the country between Laverton and Point Salvation, and overlie granite. To the east, in the country occupied by sedimentary rocks, sand-ridges are developed, which also occur, to a less extent, overlying acid rocks, near the South Australian border. No definite explanation of the peculiar tendency shown by sand derived from the western granite to form plains rather than sand-ridge country can be offered.

We were impressed throughout the expedition with the slow work of wind as a transporting agent and with its practical negligibility as a corrading agent. Wind undoubtedly removes fine dust from the country generally, and more particularly from dry lakes

* Geol. Surv. of W.A., Bull. No. 61, p. 20.

† "The Lake System of Westralia," Geog. Jour., June, 1914, pp. 656–64.

and clay pans (both of which are few and far between in these parts). But it is only where the spinifex has been burnt by the blacks that heavy sand is moved. We saw no land-forms the whole time we were out which could be pointed to as definite products of wind corrasion.

It must be clearly understood that we are not making statements which necessarily apply to physiographic processes throughout the arid parts of Western Australia but only to the particular

Fig. 1. Hann Breakaways. Looking south from near Point Craig. Note irregular "Coast Line," level "Fringing Belt" trenched by Water courses and on right, low "opposed" Breakaway.

tract now under review, in which general meteorological considerations no less than the erratic trend of the sand-ridges and our own weather notes indicate that there is no one prevailing wind.

The characteristics of breakaway country have been discussed in various publications, but as these discussions deal with breakaways in granite country, a description of the salient features of sandstone breakaways—to which belong nearly all those which we encountered—is warranted.

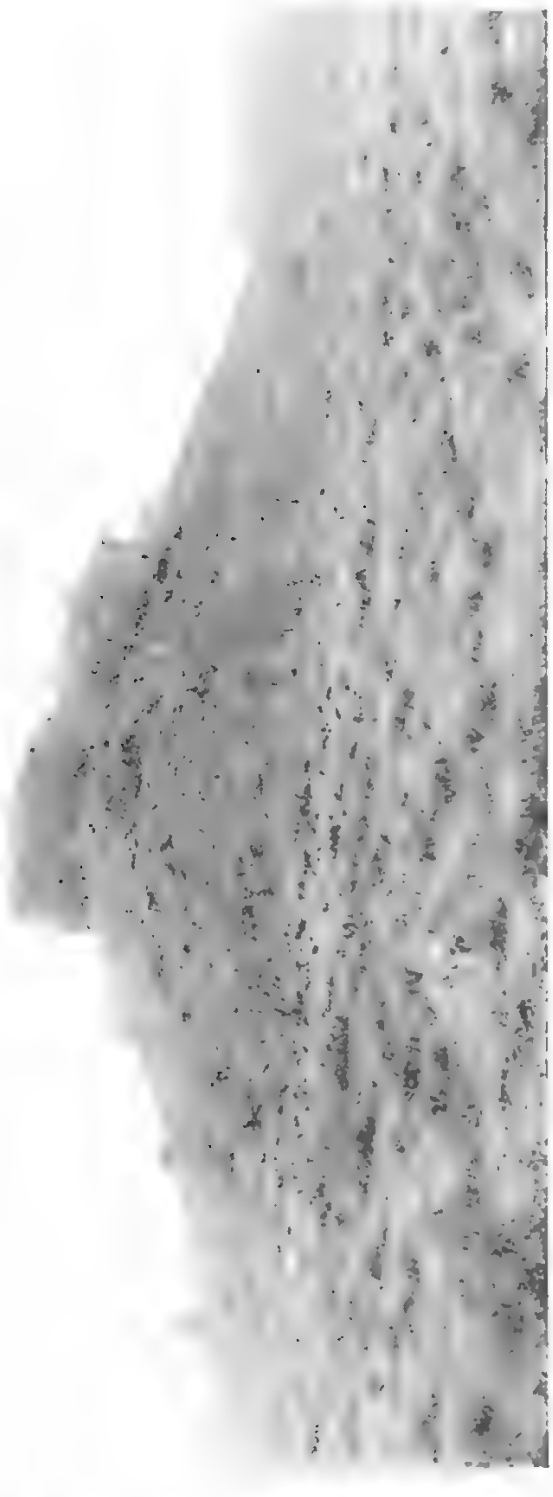

Fig. 21.—Haven Table Top. A Butte, lying off the Haven Breakaways. Note encircling Talus slope.

Breakaways are lines of low cliffs, sometimes undercut, rising above talus slopes and bearing a general resemblance to a broken coast-line, a resemblance which is heightened by the small outlying

* For example G.S.W.A., Bull. No. 45, pp. 36-7 (Talbot), No. 57, p. 20, *et seq.* (Woodward), and No. 61, p. 114, etc. (Dutson).

island-like "table-tops" or buttes (figs. 1 and 21). These cliffs are the edges of more or less extensive tracts of table-land with rough, boulder-strewn surfaces trenched by narrow watercourses. The table-lands, in the cases observed by me, always incline gradu-

FIG. 7.

Breakaway 80 feet at Point Lothian Rock Hole—Rough surface trenched by narrow gorge, 10 to 20ft. deep, in which grow ti-tree and occasional eucalypts.

ally in one direction or another into sand-country. Thus it is that breakaways which stand out prominently from some points of view are invisible from others, and that "ranges" named by one explorer have been passed unnoticed by other travellers in the same region.

The undercutting and retreat of breakaways in the country under review are due to the different resistance to weathering offered by the surface layer of ferruginous or siliceous laterite (which corresponds to some extent to the "ferruginous sandstone" of various writers*), and by the soft underlying sandstone and clay-stone. In

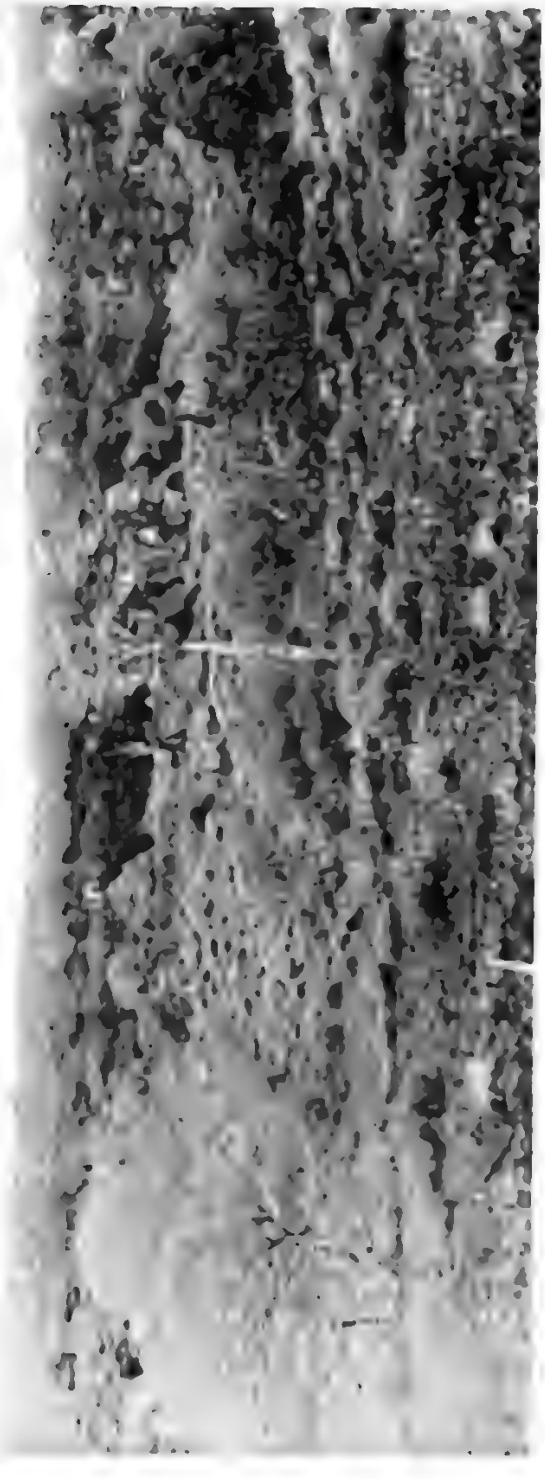

Fig. 4. Undercut Breakaways at Pedoni Lilies. Showing outcrops of rocks in Fig. 3.

the softer, less coherent rocks the considerable daily range of temperature, though unable to cause the cracks which appear in the

* A summary of the subject will be found on p. 3 of a report on the geology of the Northern Territory of Australia, compiled for Angas Downer for Session xli. of the International Geological Congress. (The copy seen by us was published "by authority" in Melbourne.)

compact laterite, nevertheless effects a flaking-off of minute particles ("mode of disintegration")[1] which are removed by wind. Animals and men seeking shelter from sun or rain help this under-

Fig. 9

Cave in Point Lillian Breakaway.—Roofed by lateritic sediments.

mining process considerably. The further destructive work of insolation in causing collapse of undermined cliffs, in reducing the blocks of talus by shattering, and in causing creep down the talus-

[1] W. Cross, "Wind Erosion in the Plateau Country," Bull. Geol. S. Soc., Am., Vol. 19, p. 58.

slopes—in which latter process much help is given by the scour of the occasional torrential rains—is considered in some detail in Bulletin 75.

The theory has been advanced that breakaways owe their inception to marine action*. It is difficult to account by this theory for the many different directions in which the breakaways seen by us face, and for the general uniformity of level between Laverton and Axe Hill. If the successive lines of breakaway cliffs mark approximately the successive halting-places of a retreating sea-margin, we would expect them to be at successively lower levels and to face roughly in one direction.

It seems more likely that the parents of the breakaways were the cliffs which overlooked the valleys of a drainage-system of a former less arid epoch. These cliffs have now been cut back from their original position by the agencies (insolation, etc.) described above. We believe that the patches of breakaway country would, had not the variable winds piled the sand against one side or another, rise abruptly everywhere above the sand-country.

2. *Hilly Zone.*—Two main types of country are recognised in this zone—that comprising the lower ground, which corresponds to the general surface of the peneplain, and the hills of various form which rise above the peneplain.

On the lower ground are developed, in different parts, sandy country and soil-plains, which latter comprise the greater part of the pastoral country to which reference has already been made.

Lithological composition plays no part in the configuration of hills in the Hilly Zone, for rocks of very different type compose ranges of the same form, and, conversely, ranges differing greatly in form are composed of rocks almost identical in structure and composition.

Besides isolated hills ("island-hills") found mainly in the areas of acidic rock, which are either the last remnants of long ridges or owe their existence to a difference in the grain of the rock or to the presence of a dolerite dyke, four fairly distinct types of hilly country may be recognised, viz:

(a) Long "whale-back" ridges with gaps at intervals, *e.g.*, Warburton and Blackstone Ranges, of acid and basic igneous rocks respectively.

(b) Stony ranges (like the Cavenagh, which is of basic igneous rock), completely dissected into isolated masses by narrow grassy flats, along which, in time of very heavy rain, water flows right through the range.

* Montgomery, in G.S.W.A., Bull. No. 50, p. 40, and Jour. & Proc. Roy. Soc., W.A., Vol. II., p. 59, *et seq.*

(c) Large dissected masses, like the west end of Tomkinson Range at Mt. Aloysius, or like Mt. Squires, which are in acid rocks—very highly metamorphosed in the first case.

(d) Escarpments in gently inclined sediments, *e.g.*, Townsend Range.

Hill-groups of type (b) are residuals of erosion on which a pre-existing drainage system has been imposed, whereas type (c) already existed as water-partings in that drainage-system.

Water-courses, though of frequent occurrence both in the Hilly Zone and in Breakaway Country, do not persist far from the higher ground, but soon lose their identity on the level country.

GEOLOGY.

1. *Laverton to Dunges Hill.*—In microscopic as well as general characters, the rocks occurring as far east along our route as the vicinity of Dunges Hill are of the two types –granite and greenstone*—which constitute the staple formations of the Western Australian goldfields. Granite is predominant, and in it occur two small belts of "greenstone" (*i.e.*, metamorphosed igneous rocks, probably originally doleritic in character), that are more or less in alignment with those greenstone belts at the Cosmo Newberry Range and at Mt. Shenton respectively which Gibson has described.†

2. *Dunges Hill to Townsend Range.*—Between Dunges Hill and the neighbourhood of the Warburtons, the country traversed by us is entirely composed of a series of horizontally bedded, slightly compacted and altogether unmetamorphosed sandstones and claystones, with occasional boulder-beds, or of the waste from these rocks, which we have temporarily named the *Wilkinson Range Series*.

Regarding the finer-grained beds of this series, it need only be mentioned that they frequently show marked current-bedding and contain isolated boulders and pebbles which have the same peculiarities as those composing the boulder-beds.

As the boulder-beds are of interest, we repeat here almost verbatim the descriptive and other remarks of Bulletin 75.

In many places, near the foot of breakaways between Lily Rock-Hole and Axe Hill, a distance by our route of about 200 miles, are strewn numbers of rock-fragments, varying in size from mere pebbles to boulders weighing several hundredweight. Along the west side of the Point Saunders breakaways, these boulders are nearly all derived from a definite boulder-bed, about 15 feet thick, which is the lowest visible member of the Series, and is covered

* In the "Explanation" of Plate II. the letters (D and G) and rulings for greenstone and granite have been reversed. They should be as in Plate I.

† G.S.W.A., Bull. No. 24, pp. 66–73.

by 100 feet or more of the finer sediments already mentioned in which an occasional boulder or pebble can be found. A short distance north of Fetherstonhaugh Hill, a similar boulder-bed can be seen. Again, in Wilkinson Range, near Lily Rock-Hole, the fact that boulders are not found above a certain height on the talus-slopes of the breakaways indicates that there is a definite boulder-bed.

Since the sandstones, etc., which comformably overlie the boulder-beds, are everywhere horizontal, and since the country between Wilkinson Range and Fetherstonhaugh Hill is practically level (according to heights determined by aneroid), the boulder-beds must form, if not a continuous stratum, at any rate a definite horizon for this distance.

The majority of the medium-sized boulders and pebbles examined agree in shape, being rounded and smoothed as by water action, but with one conspicuously flattened side which, in some cases, is traversed by grooyings independent of the rock structure (fig. 6). Occasionally facetted boulders were found (fig. 7).

Fig. 6.

Glaciated Gneiss Boulder.—From Wilkinson Range Beds, about one mile south-west of Lily Rock-Hole. Foliation planes (dimly visible) make an angle of about 70° with the scratches. (About half natural size.)

The larger fragments, weighing two hundredweight or more, are well rounded, but we did not ascertain whether the flattened

side which, after the weathering of the boulders, seems generally to settle undermost, was present.

The most obvious explanation for boulders of such shapes is that they are water-worn rock-fragments, which became embedded in the foot of a glacier, the flat faces being produced by grinding against the rocks over which the glacier was passing.

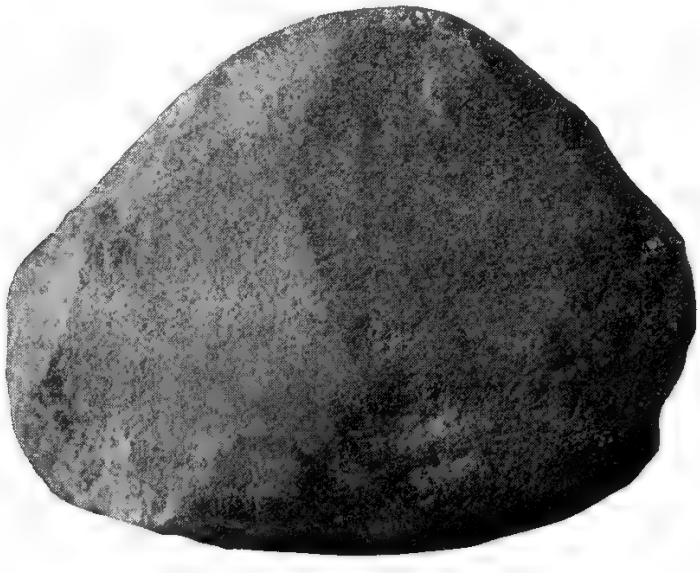

Fig. 7.

Facetted Quartzite Boulder.—From Wilkinson Range Beds, about one mile south-west of Lily Rock-Hole. (About half natural size.)

A boulder-bed of such constant thickness and comformity with overlying and underlying shallow-water sediments could not be a sub-aerial morainic deposit, but must have been formed of debris dropped in shallow water by icebergs.

Many different rock-types were found among the boulders of the Wilkinson Range. These have not been examined microscopically, but the following list of hand specimens, in which the most abundant types are described first, the rarest last, may be of interest:—

Coarse gneissic granite, like some of the types from the Warburton Area, intermediate between the "pink" and "grey" rocks (see below, p. 86).

Granular-crystalline pink granite, like some of the "pink rocks" of the Warburton Area.

Granular-crystalline rocks, resembling coarser varieties of the pink granular porphyries from the Warburton Area.

Gneissic, pink-and-grey, biotite granite.

Gneissic rock, resembling that from Bentley Hill, east of the Warburtons.

Fine-grained grey granular granite, with coarse microcline-pegmatite areas.

Dull pink-grey sericitic gneiss, like "holz-gneiss."

Pink aplite.

White and blue quartz.

Finely foliated and sheared dark-grey biotite gneiss.

Quartzite, like that of Townsend Range (see below, p. 92).

Unsheared quartz-porphry, like that of Warburton Area.

Some of the coarse granitic rocks resemble the pegmatite facies of the granites near Kookynie, but otherwise rocks resembling in hand specimens the commoner acidic members of this assemblage have not yet been described in Western Australia.

Boulders of granite were found only in Wilkinson Range. Elsewhere the largest boulders were quartzite like that of Townsend Range; the smaller boulders were quartzite and quartz, and, at Point Saunders, in addition to these, a highly siliceous rock—apparently completely silicified limestone.

As will be presently remarked, quartzites of the Townsend Range type occur over wide areas north-west, north, and north-east of the Dunges Hill—Townsend Range section. They are unknown to the south.

Our failure to find a variety of rock-types in any of the boulder-bed exposures, except that at Wilkinson Range, may of course be due to hurriedness of observation. If, however, the variety is really absent from the boulder-beds north of Wilkinson Range, we must conclude that the bergs which dropped such a rich assortment of debris over the site of Wilkinson Range originated from glaciers which probably lay on an area of crystalline rocks west of the Warburtons, and were different from the bergs responsible for the boulder-beds farther north.

In any case the evidence seems to show that, at the time of formation of these beds, glaciers vigorous enough to descend to sea-level occupied country as near the tropics as lat. 26° 30′.

Fossils have not been found in the Wilkinson Range Series, and, in attempting to correlate it with previously described formations containing evidence of glacial action, we meet with little satisfaction.

The permo-carboniferous Lyons Conglomerate * presents apparently indisputable evidence both of its age and its glacial origin. There is nothing except their glacial origin to support correlation of the boulder-beds under discussion with this conglomerate, and, considering the geographical position of the Wilkinson Range Series, we are justified in turning rather to Central and South Australia for its homologue.

* "Relics of the Permo-Carboniferous Ice Age in Western Australia:" By A. Gibb-Maitland, F.G.S. Jour, Nat. Hist. and Sc. Soc. of W.A., Vol. iv.

The "low hills" frequently passed by the Elder Exploring Expedition in the country south of our route are probably of the same character as the breakaways along the Dunges Hill—Townsend Range Section. These hills are composed of sandstone, clay, etc., in which beds of "waterworn" quartz pebbles occur frequently. Streich* classified them as doubtfully Mesozoic, relying on their "lithological and stratigraphical features which are in agreement with those of the typical area in Australia. Moreover, they resemble the Cretaceous deposits met with in the early part of our journey, which have been proved to be of that age by means of fossils."

According to Tate and Watt† the argillaceous strata round Lake Eyre (*i.e.*, presumably the "deposits met with in the early part of our journey" to which Streich refers) are proved palæontologically to be Upper Cretaceous. These argillaceous strata are capped by a hard flinty quartzite or chalcedonised sandstone varying up to 50 feet in thickness, which forms the topmost bed of the tableland country, and is generally called the Desert Sandstone. To this quartzite Tate and Watt assign a supra-Cretaceous age.

Amongst many other localities in which these Cretaceous strata are said to occur is (op. cit. p. 64) "the Finke River from Henbury to Crown Point, which flows approximately along the junction of the Cretaceous arenaceous beds and the impervious Ordovician limestones."

However, later investigations by Spencer and Byrne.‡‡ summarised by the Glacial Research Committee of the Australasian Association for the Advancement of Science, showed that on the Finke River at Yellow Cliff a pebble-layer about three feet thick occurs, the pebbles of which show undoubted evidence of glacial action. After discussion, the opinion is expressed that the evidence, "slender as it is, is in favour of a Permo-Carboniferous age for these traces of glaciation in Central Australia." The adjective "slender" seems fully merited.

Another possibility was suggested by H. Y. L. Brown,§ who, in the course of an extended geological reconnaissance in the west and north-west of South Australia, noted that, "on the stony downs, gravelly plains and tablelands, boulders and blocks of rock are frequently seen resting on Cretaceous shale and silt. These consist of quartzite, clay, siliceous slate, felspar, porphyry, sandstone, and quartz, etc. One solid block measured 5ft. by 4ft. by 1ft. 8in., and larger but shattered blocks occur; these, without doubt, have been transported to their present position by ice action,

* Trans. Roy. Soc., S.A., xvi., pp. 91-2.

† Rep. Horn. Expd. Part iii. p. 62, *et seq.*

‡ Aust. Assoc. Adv. Sc., Sydney, 1898. "Report on the Occurrence of Glacial Boulders at Yellow Cliff . . . . Central Australia."

§ Rep. Geol. Exp. in W. & N.W. of S.A. S.A. Parl. Paper, No. 71, 1905, p. 5.

which seems to have, at some time since the Mesozoic period, been in operation all over the region."

Again (p. 6), he noted the occurrence of a granite erratic "suspended in shale" at a depth of 3,100 feet in the Arkeeta clay-pan bore. This he considered to be evidence of ice action at the time the shale was deposited (the rocks shown at the surface on the map are Post-Tertiary).

Jack* describes Upper Cretaceous rocks from the north flanks of the Everard Range and elsewhere in the western portion of the area with which he deals. He also (pp. 42-4) discusses the probability of drift ice in the Lower Cretaceous sea to account for the wide distribution of erratics, as already noted by Brown. He favours this explanation of the erratics rather than the view that they are boulders of the Cambrian till (which he discovered near Moorilyanna Hill) redistributed by torrential streams in geologically recent times.

It appears to us that the little evidence which we have favours the assigning of a late Mesozoic or Tertiary age to the Wilkinson Range Series.

3. *Warburton Area.*—On reaching the Warburton Area (which is conterminous with the Hilly Zone, described in the physiographic section) we pass into a region which, in the variety of its geologic problems as in its topography, is in sharp contrast with the monotony of the Desert Zone. In this area of about 3,000 sq. miles are found, not only metamorphosed rocks of basic igneous (the oldest), of acid igneous (occupying the most extensive area and including those—the charnockites—of widest interest), and sedimentary origin, but also later groups of unmetamorphosed basic igneous, and of associated basic igneous and sedimentary rocks. The Warburton Area shows resemblances both to Central Australia and to Western Australia in the character of its rocks, but, in the prevalent east and west trend of the formations, is seen a resemblance to the structural geology of Central rather than to that of the parts of Western Australia south of lat. 26°. It is unfortunate that, owing to the extensive mask of Wilkinson Range beds in the Desert Zone, we have no notion as to how the north-and-south bands of greenstone and granite, which are so prominent a feature of Western Australian geology south of lat 26°, pass into the Warburton arrangement of east-and-west bands.

It is not proposed to enter into much detail here regarding the older formations, but some remarks may be made explanatory of plate I. which shows the broader geological features of the Warburton Area:—

Greenstones.—The oldest rocks of the Area are "greenstones" —probably dolerites highly metamorphosed—which are divided into four belts by great dykes of acid rock, and which cover, in all, an

* Geol. Surv. S.A., Bull. No. 5, p. 24.

area of about 400 square miles. Greenstones of similar character are common in the gold-mining centres of Western Australia, and have been described in many of the bulletins of the Geological Survey of this State. They further resemble the Western Australian greenstones in carrying quartz veins. During our expedition several specimens of quartz were collected which yielded traces of gold. We consider that the area would certainly deserve prospecting were it not so far removed from all mining facilities that only very rich deposits could be worked at a profit.

When, however, we search geological reports on Central Australia for records of similar rocks we find that, if present at all, they are not developed extensively enough to warrant distinctive mapping. Possibly, however, greenstones are included with the rocks shown under such titles as "Granite and undifferentiated gneisses and schists of igneous or sedimentary origin, with numerous dykes of granite, pegmatite, dolerite and gabbro." It is apparently in such rocks that gold-bearing veins occur in the Arltunga Goldfield in the Macdonnell Ranges.*

In the relatively large development of greenstones, therefore, the geology of the Warburton Area resembles that of the Western Australian goldfields, and differs from that of the rest of Central Australia.

Metamorphosed Acid Igneous Rocks.—Of the 3,000 square miles included in the Warburton Area more than 2,200 are occupied by Acid Igneous Rocks, all more or less metamorphosed (figs. 8 and 9). Microscope work combines with field work to show that these acid rocks despite their great variety are of common magmatic origin. It does not, however, follow that all consolidated from the molten state at the same time, and there is indeed some reason to think that the great dykes of porphyry, together with the western portion of the main granite mass (which is characterised by a prevalent pinkish colour), are of somewhat later date than the main mass of granite lying farther east, which is usually grey in colour.

Regarding their affinities to Central Australian rocks,† Mr. Farquharson has found that the acid metamorphosed rocks of the Warburton Area show close affinities to those described from the Macdonnell Ranges in the report of the Horn Expedition, and to those from the north part of South Australia reported on by Streich, Basedow and R. Lockhart Jack, and he concludes that the rocks of this type throughout the parts of Central Australia mentioned above must be of the same age and form part of the same rock-mass.

Mr. Farquharson considers that the Pink Granites and porphyries somewhat resemble rocks found near Kookynie, but that

* See for example H. Y. L. Brown's "Report of Geol. Exam. of Country in neighbourhood of Alice Springs." S.A. Parl. Paper, No. 189, 1890, p. 2.

† See Plate II. and footnote p. 80.

Fig. 8.

Mt. Aloysius from the south-west.—A "Dissected Mass" of granulitic rock. Note dolerite dykes.

the very coarse-grained granitic rocks of the Warburton Area differ fundamentally from those of the Western Australian gold-

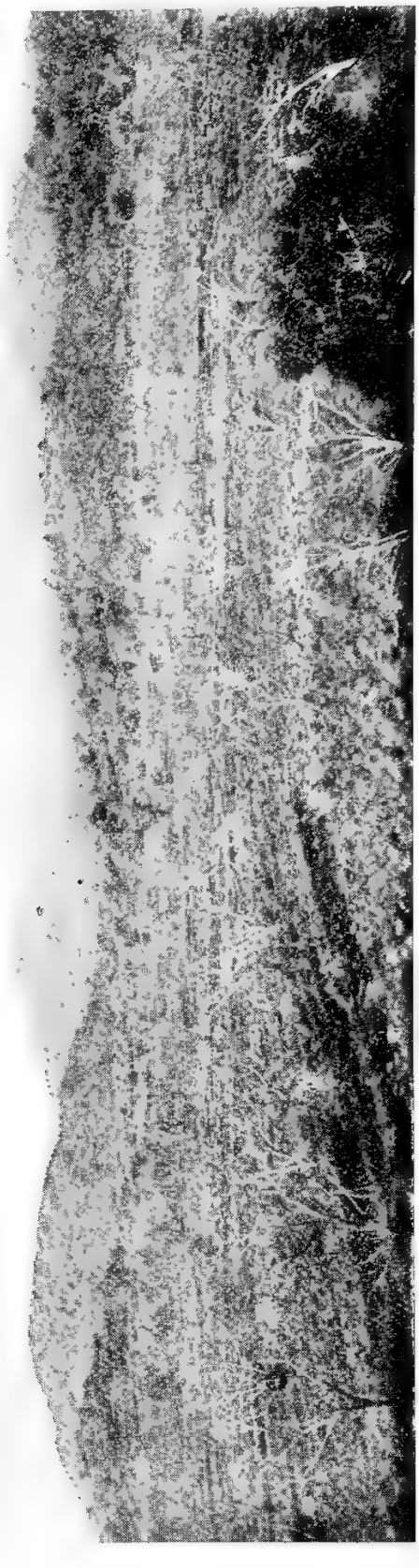

Fig. 9.

Mt. Gosse from the West.—A "Dissected Mass" of gneissic granite.

fields in that the former are gneisses produced by great regional metamorphism, whereas the latter are true granitoid rocks foliated solely or mainly along the margins of the masses.

There are two views as to the original character of the rocks shown by one symbol on our geological sketch map and described usually by such general titles as "Granites and undifferentiated gneisses," etc. Brown,* Streich, † Basedow, ‡ Jack § and others consider that, while some are metamorphosed igneous rocks, others are of sedimentary origin; Tate and Watt ‖ find no evidence, in the region which they examined, for assigning a clastic origin to any of the gneisses and similar rocks, and criticise the views of Brown and others, so far as these views apply to the geology of the Macdonnell Ranges.

Work by Mr. Farquharson and our own field observations tend to show that all the metamorphosed acid rocks of the Warburton Area are igneous in origin.

Finally, attention must again be drawn to the recognition by Mr. Farquharson of Charnockite affinities in rocks collected by us from Cohn Hill—another point of similarity between the rocks of Australia and those of India and Africa on the significance of which further comment is made in Bulletin No. 75.

Metamorphosed Clastic Rocks.—Several small patches of agglomerate, greywacke, and quartzite, all showing signs of dynamic strain, are found among the acid igneous rocks. It is possible that larger areas exist in the country east of Mt. Squires which we did not visit. The resemblance of some of the rocks to members of the Kurrawang Series ¶ near Kalgoorlie, which Honman considers Algonkian in age, has already been noted by Gibson,** who examined specimens brought back by Mr. F. H. Hann. We have not found reference to similar rocks in Central Australia, except perhaps some of the Pre-Cambrian or Cambrian fragmental rocks described by R. Lockhart Jack and others.

Unmetamorphosed Basic Igneous Rocks.—The rocks of this group occur, some as well-defined dykes (Fig. 10), others as large masses (Cavenagh and Blackstone Ranges, Fig. 11), apparently intruded into the formations already described. As a rule they are remarkably fresh and show no signs of dynamic metamorphism, and so are doubly proved younger than the greenstones, granites, and metamorphosed clastic rocks. So far, then, our classification is natural and satisfactory.

The further separation, in Bulletin 75, of these basic igneous rocks into two subdivisions—Basic Plutonic Rocks (gabbros, norites and coarse dolerites) and (younger) Basaltic Dolerites—is, however, of doubtful value, being supported only by a single observa-

* Parl. Paper, No. 45, 1890, p. 2.
† Trans. Roy. Soc. S.A., Vol. xvi., p. 82.
‡ Trans. & Proc. & Rep. Roy. Soc., S.A., Vol. xxix., p. 62.
§ Geol. Surv., S.A., Bull. No. 5, p. 15.
‖ Rep. Horn Scientific Exped., Part iii., p. 40, etc.
¶ G.S.W.A., Bulins. Nos. 56 and 66.
** G.S.W.A., Bull. No. 42, p. 15.

tion (at Fort Welcome in the Cavenagh Range), on the correctness of which a good deal of doubt is thrown by petrological evidence. The correctness or otherwise of our field-work can be decided only by re-visiting Fort Welcome, and it seems best to draw attention to the discrepancy between field and microscopic work by separating the finer-grained basaltic dolerites from the coarser gabbros and dolerites as a younger series, while making it perfectly clear that

Fig. IV.

Dolerite Dyke forming a Knoll.—Hill about seven miles west of Mt. Aloysius.

this subdivision is founded on a single, possibly faulty, observation. If this one observation were ignored, it would be natural to regard all the Basic Igneous Rocks of Doubtful Position as more or less contemporaneous extrusions from the same magma. Within wide limits the age of a basaltic dolerite dyke at Table Hill (supposedly one of the younger dolerites) is known, for it intrudes

volcanic flows of probable Ordovician age, and its denuded edge is overlain by the Wilkinson Range beds, which, as already stated, are thought to be late Mesozoic or Tertiary.

Fig. 11.

Mt. Madley (Warburton Range)—From west, looking across Mt. Madley Creek.

Rocks petrologically identical with these gabbros and norites are found in several places in Western Australia,* and rocks very like the basaltic dolerites occur at Sandstone, Cue, and Meekatharra,† cutting across ore-bodies. It has been supposed that the plutonic phase and the basaltic dolerite phase are of common magma

* Cue, see G.S. W.A., Bulls. No. 14, p. 15 and No. 20, Part II., p. 51. Norseman, see Bull. No. 21, p. 24. Barlowerie Peaks, see Bull. No. 48, p. 64.

† G.S. W.A., Bulls. No. 62, pp. 34-40; No. 57, p. 40; No. 48, p. 64.

matic origin* and that, since the Oakover limestones are intruded by apparently similar dolerites, the dolerite of Sandstone, etc., is even of post-tertiary age.†

Comparisons based only on petrological detail are, of course, of little value, but it may be noted, as unfavourable to the post-tertiary age of the dolerite from Sandstone, etc., that the basaltic dolerites of the Warburton Area are apparently of distinctly later age than gabbros which also closely resemble the gabbros of the Western Australian goldfields, and that these basaltic dolerites are apparently Post-Ordovician and Pre-Tertiary in age.

Turning now to Central Australian geology, we find a very close resemblance in every respect between the gabbros, norites and coarse dolerites of the Warburton Area and those occurring further east. Microscopic resemblances are dealt with by Mr. Farquharson, but the following general statement by Jack applies to the occurrences noted by us on the western side of the Border:—

> The last constructive phase in the building up of the Pre-Cambrian complex was the injection of an extensive series of basic dykes. . . . The basic dykes range in size up to one or two hundred feet in thickness. . . . They cut through all the Pre-Cambrian rocks indifferently. . . . . Being in general harder than the enclosing rocks, the dykes form prominent dark-coloured outcrops which weather into large blocks and masses. ‡

Townsend Range Series.—As we do not wish to devote any space to the discussion of the various types of superficial deposits encountered, there only remains to be considered a series of sedimentary and contemporaneous volcanic rocks called the Townsend Range Series because quartzite, of which Townsend Range is composed, is its most prominent member.

From below upwards the constituents of this series are: conglomerates, volcanic flow-rocks, calcareous grits, and quartzites. The stratified members of the series, and in places also the flow-rocks, strike east and west and dip south at about 20°. The series has not been dynamically metamorphosed. Its beds were found in several places outcropping within a few chains of the metamorphosed rocks. In such cases the low dip and little altered character of the Townsend Range Series contrasted so strongly with the structure of the metamorphosed rocks that no doubt could be felt that the former overlies the latter unconformably.

The conformity to one another of the conglomerates, volcanic flow-rocks (although indeed those of Table Hill are included in the series only on petrological evidence) and calcareous grits was seen fairly clearly in the field, but the 300 or 400 feet of buff-coloured quartzites (Fig. 12), which form the uppermost and most prominent portion of the series, have not been found in contact with the underlying beds. However, the strike and dip of the quartzite are

* G.S. W.A., Bull. No. 68, p. 86.
† G.S. W.A., Bull. No. 68, p. 64.
‡ Geol. Surv. of S.A., Bull. No. 5, p. 18.

parallel to those of the conglomerates, etc., and it seems unwarrantable in the absence of more decided evidence to introduce another series without counterpart in Central Australian geology.

Fig. 12.

Townsend Range Series.—Bluff of quartzite near Ely and Camps, Lilian Creek.

No fossils having been found in the sedimentary rocks of the Townsend Range Series, their age is not directly determinable. However, we propose to show, as briefly as possible, that there is fairly good proof of their Ordovician age if we correlate them with similar rocks to the east.

On the "Map of the Route travelled by the Elder Exploring Expedition," Stuart showed a band of "Palæozoic (Devonian)

* Trans. Roy. Soc., S.A., Vol. XVI

rocks extending from the south-west end of Everard Range to Townsend Range. He did not himself visit the Warburton Range, but, from specimens brought by others, mapped it (with some hesitation), and also two other bands to the north-west, as Devonian. The reputed Warburton specimens probably came from the escarpment south-west of Hughes Creek.

From his description* it is evident that this "Devonian" band is constant in character throughout its length, its predominant bed being quartzite like that of Townsend Range.

Near Lake Macdonald the staple formation observed by Tietkens† was "Devonian" quartzite.

The idea that this widely distributed formation was of Devonian age appears to have originated in H. Y. L. Brown's "Report on Journey from Warrina to Musgrave Ranges," ‡ in which he compares the quartzites south-east of Everard Range to the "tenthills of Port Augusta and the flat table ranges on the Hugh River south of the Macdonnell Ranges." The tenthill formation he had previously § correlated with the Devonian beds of New South Wales.

Tate and Watt, however, ‖ found numerous Ordovician fossils in quartzites and limestones in various places south of the Macdonnell Ranges, and considered that the quartzites found by Tietkens near Lake Macdonald were also Ordovician.

Brown¶ later acknowledged the probable Ordovician age of the quartzites, etc., near Arcoeillinna, at Chambers Bluff, Mt. Chandler, etc., and Jack,** by speaking of the Ordovician rocks "mapped by the late Victor Streich," makes it clear that the latter's "Devonian" right through to the Warburton Area may, with tolerable certainty, be regarded as Ordovician.

It must be noted, however, that whereas in the Ordovician rocks south of the Macdonnells there is a marked absence of volcanics,*** such rocks are (if we are justified in regarding the conglomerates, volcanic rocks and grits as *conformably* overlain by the quartzites) well represented in the basal part of the Townsend Range Series.

Regarding similar rocks in Western Australia:—

A series showing striking resemblances in lithological character and in geological structure to the Townsend Range Series occupies a great area to the north of lat. 26°, outliers of it being found for about a degree farther south (see Plate II.).

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* Loc. cit., pp. 77, 82.
† S.A. Parl. Paper, No. 111, 1889.
‡ S.A., Parl. Paper, No. 45, 1890.
§ S.A., Parl. Paper, No. 35, p. 10, 1884.
‖ Report Horn Exped., Part iii., p. 46, *et seq.*
¶ Rep. on Geol. Expl. in West and North-West of S.A. (Parl. Paper, No. 71, p. 9, 1905).
** Geol. Surv., S.A., Bull. No. 5, p. 23.
*** Rep. Horn. Exped., Part iii., pp. 53–4.

Quartzites identical with those so strongly characteristic of our Townsend Range Series form the bulk of the eastern portion of this series also; but, west of the No. 1 Rabbit-Proof Fence, shales and fine-grained sandstones replace the quartzites to a large extent.

The whole formation has been thrown into a succession of gentle folds, the axes of which trend east and west, with the exception of the folds concerned in Throssell and Albert Edward Ranges, which trend north-north-west and north-north-east respectively.

East of the Rabbit-Proof Fence the central portions of the broad anticlines in the resistant quartzites of this series have been removed by denudation, leaving the gently dipping beds of each leg to stand up as separate and parallel lines of hills. Consequently each range shows strata dipping in one direction only. There is, however, one notable exception to this rule. In the west part of McKay Range the quartzites on the south side of the range dip south at about 60°, while on the north side they dip north at about 30°. East of McKay Range the general rule asserts itself, the arch of the anticline having been removed and its site being marked by a flat.

Between No. 26 Well on the Canning Stock Route and Albert Edward Range this series is unconformably overlain by horizontally bedded sandstones and shales of whose Carboniferous age Hardman obtained evidence.*

In the following places unconformity with older rocks has been observed:—

Albert Edward Range: where the quartzites, etc., rest upon the auriferous series (schists, etc.) of Kimberley, lithologically similar to the Warrawoona Beds of Pilbara, † the dip of the quartzites being 45° to S.E.

Larranganni Bluff at south end of Gardner Range, close to the South Australian border near lat. 19° 30′: where quartzites dipping 10° to N. rest on highly inclined sediments (traversed by quartz reefs) which correspond to the Mosquito Creek Beds of Pilbara‡ (and possibly to the Metamorphosed Sediments of the Warburton Area and to the Kurrawang Series).

Near Pierre Spring on Canning Stock Route: where a basal bed of quartzose conglomerate overlain by quartzite similar to that of Townsend Range dips to N. at 45°, and rests unconformably on highly inclined sediments exactly similar in character to those at Larranganni Bluff.

Since the Nullagine Beds § (grits, sandstones and conglomerates with interbedded lavas), dipping W.N.W. at 25°, also rest

* Rep. on Geol. of Kimberley Dist. Perth, 1884, p. 9.
† G.S.W.A. Bull., No. 40, p. 155, *et seq.*, also Bull. No. 23, p. 78.
‡ G.S.W.A., Bull. No. 23, p. 78.
§ G.S.W.A., Bull. No. 23, p. 78.

unconformably on the Mosquito Creek Beds, it seems probable that they are part of the great series just described, which, as we have seen, may reasonably be correlated with the Townsend Range Series.

There seem, then, to be reasonable grounds for correlating the Townsend Range Series with that of Pre-Carboniferous age which extends southwards from the Kimberleys. But this series is mapped as Devonian by Hardman* and R. Logan Jack,† whereas we have shown reason for correlating the Townsend Range Series with rocks which South Australian geologists seem now agreed to regard as Ordovician.

It is necessary to summarise the evidence which Hardman and Jack adduce for assigning a Devonian age to the Kimberley rocks in question.

In his first report Hardman does not refer to Devonian rocks, but in his second report dealing with country farther east he says (p. 20): "South of the Mueller Ranges are first seen a series of rocks which bear no resemblance to the true Metamorphic series on the one hand, nor to the Carboniferous on the other. They consist of beds of grey, red, and greenish hard grits and conglomerates, hard limestones . . . and beds of shale, often of a slaty character . . . there can be very little doubt that they are of Devonian Age, seeing that they rest unconformably on the Lower Silurian [or, in first report, Cambro-Silurian] schists and slates [Metamorphic series], and are in part covered by the basaltic rocks . . ., which are in turn covered by Carboniferous limestone."

Apparently, however, he had no very definite grounds for assigning a Cambro-Silurian or Lower Silurian age to this "Metamorphic series"—the auriferous series of Kimberley referred to above. Indeed in a footnote on p. 6 of his first report he remarks that the Lower Silurian or Cambro-Silurian are "provisionally classed thus; but it is not improbable that these rocks, as well as similar formations in this Colony, and the other Australian Colonies, may be of Laurentian age."

Dr. Jack divides the Carboniferous rocks of the Kimberley District into an Upper or Sandstone and a Lower or Limestone series. On palæontological grounds he regards both series as undoubtedly Carboniferous in age, but notes that H. A. Foord, in the Geological Magazine for 1900, described several Devonian fossils presented by Hardman to the British Museum. According to the labels these fossils came from Rough Range and Mt. Pierre—localities from which many of Hardman's Carboniferous fossils were derived. Dr. Jack therefore considers that the limestone

* E. T. Hardman (1) "Rep. on the Geol. of the Kimberley Dist." Perth, 1884.
(2) do. do. do. do. 1885.
(Each report was illustrated by a geological map.)

† R. Logan Jack "The Prospects of obtaining Artesian Water in the Kimberley District," G.S.W.A., Bull. No. 25.

region near Mt. Pierre mapped as Carboniferous partly consists of limestone of an older date. Moreover (op. cit. p. 11), he describes the occurrence near Minnie Pool, a quarter of a mile south of a well-bedded Carboniferous limestone, of limestones whose "strong Devonian aspect struck me at once." The limestones of "Devonian aspect" contained large quantities of badly preserved corals, regarding three of which Mr. Robert Etheridge "writes that [they] are Stromatoporoids, and are, therefore, either Silurian or Devonian, certainly not Carboniferous." Jack concludes (p. 12) that "either there are, in the locality in question, separable Carboniferous and Devonian strata, or the same strata contain a Devono-Carboniferous . . . fauna."

The occurrence of Devonian rocks in the Kimberleys was further established at about the time of Dr. Jack's visit by Mr. H. P. Woodward, who found fossils of Devonian age in the limestones of Barker Gorge in the Napier Range. These were examined by Dr. Henry Woodward.*

These Devonian beds, however, all lie in limestone areas mapped by Hardman and Jack as Carboniferous. We have been able to find no satisfactory evidence that the more arenaceous formation mentioned above as forming the Albert Edward Range, extending thence southwards to latitude 26° or farther, and overlain unconformably by Carboniferous beds, is of Devonian age as mapped by Hardman and Jack, or that its equivalents farther north, mapped by the same geologists, are of Devonian age.

Hardman's reasons for assigning them to this age have been already cited. Dr. Jack opens his description of the rocks of the Kimberley District, which he definitely maps as Devonian, with a summary of Hardman's work and then proceeds (p. 12): "In my traverse the Devonian rocks were first met with at Goose Hill, 12 miles from Wyndham . . . They form the ranges on the left bank of the Ord River west of the Ivanhoe Stud Station." He does not adduce any palæontological evidence in favour of their Devonian age, but regards the rocks of Osmond Range (seen at a distance) as similar to those of Ivanhoe Stud Station and says "I have no hesitation in mapping [them] as Devonian."

Finally we may draw attention to a paper† by Mr. L. Glauert, in which he notes the large extent of Ordovician rocks mapped in the Northern Territory up to the West Australian border in "Mr. Brown's map of 1906," which we have not seen.

4. *Summary.*—Following are the outstanding results from the point of view of general geology, which have been obtained inci-

* An account of this important discovery is given by Mr. L. Glauert in G.S W.A., Bull. No. 36, p. 111.

† "The Protozoic Rocks of the North of Western Australia." Jour. Nat. Hist. & Sc., Soc. of W.A., Vol. iv., p. 51.

dentally in the course of an expedition to ascertain the auriferous possibilities of country in the far east of this State:—

Glacial beds exist in the "desert" tracts of Western Australia near lat. 26°. We believe them to be late Mesozoic or Tertiary in age.

The sedimentary rocks of the Townsend Range Series, which on comparison with Central Australian geology must be regarded as Ordovician, show marked resemblance to a series regarded as Devonian in Western Australia, but on evidence which seems to us inconclusive.

The country near the Border, about lat. 26°, is composed largely of ancient rocks which strongly resemble the metamorphosed rocks of Central Australia except that in the comparatively strong development of "greenstones" they differ from the Central Australian rocks, and show decided affinities to the great metamorphic areas of Western Australia.

GYROSTATIC ACTION.

By

Professor A. D. Ross, M.A., D.Sc., F.R.S.E., F.R.A.S.

(*Paper read before the Society on 10th August*, 1915.)

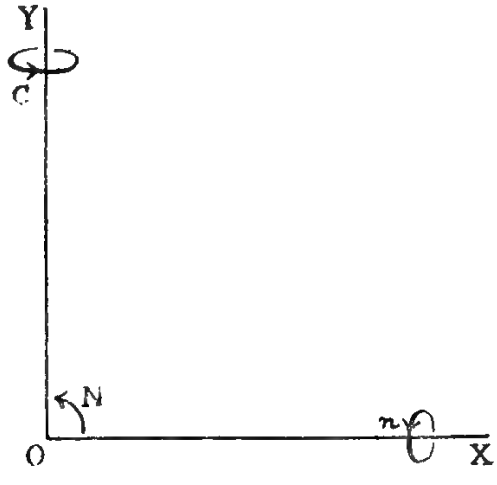
Everyone is familiar with the peculiar stability acquired by a boy's top or a hard boiled egg when set in rapid rotation about its axis of symmetry. In such experiments gravity appears unable to lower the centroid of the body as it would do if the rotation were non-existent. Instead of the body falling over under the action of the couple or pair of forces formed by the weight of the body and the upward reaction of the supporting table or ground, the body "precesses," that is to say, its axis of figure has a slow conical motion, the rate of which increases as the rate of spin decreases. In connection with such experiments it is important to realise first the cause of this behaviour and secondly the various ways in which it comes into play in nature.

In a collision between two bodies, the impact depends upon the momentum of the bodies concerned. Momentum depends upon the velocity and the mass of the moving body. It has been called "quantity of motion," a term which, while scientifically undesirable, still conveys the general idea of what is meant. The momentum of a body can be altered by changing its velocity. Velocity, in turn, may be altered by changing its magnitude, or its direction, or both. Thus the velocity of a man running at constant speed round a circular racecourse is constantly altering. At one instant his velocity may be ten miles an hour northwards, at some later instant it will be ten miles an hour southwards -a very different thing. To alter velocity force is necessary, whether the velocity be altered in magnitude, in direction, or in both. Thus when a stone attached to a string is whirled round at constant speed in a circle, the change in its velocity (as regards direction) is supplied by the action of a force (the tension) transmitted through the string to the stone. Conversely, if a force is free to act on a moving body, the velocity of the body will be altered in magnitude, in direction, or in both.

When we deal with rotating bodies, we have to consider not momentum (as in onward motion), but what is called angular momentum. This quantity depends upon the rate of spin and upon the mass and the arrangement of the matter of the body. The angular momentum will be altered if either the rate of spin is altered or the direction of the axis of spin is altered, or if both be altered. To alter this angular momentum about the axis of

spin, the application is necessary of forces which have leverage (that is, which could produce turning) about the axis of spin. Similarly the free action of such forces about *any* line passing through a rotating body must produce change of angular momentum about that line, either by altering the rate of spin of the body, or by altering the direction of the axis of spin, or by altering both.

Let OX be the direction of the axle of a flywheel, the wheel spinning counter-clockwise as seen by an observer looking in the direction from X towards O. Let now the axle be subjected to the action of forces tending to raise O above and to depress X below the plane of the diagram—that is the forces have counter-clockwise



leverage about YO. Then the action of the forces is to generate angular momentum about OY, not by altering the rapidity of spin about the axle, but by turning the axle from the position OX towards the position OY. If the axle is pivoted at O it will "precess" or rotate round O in a counter-clockwise direction as seen looking down on O. Note that the forces do not turn the axle out of the horizontal plane as they would do if the flywheel were not spinning: their action is merely to cause motion about a vertical axis through O, which axis is at once at right angles to the spin axis OX and to the couple axis OY, as the axis about which the forces act is called.

Conversely, if the axle of the spinning body lies along OX, and is turned towards OY, forces forming a couple must be applied round axis OY. If I is the moment of inertia of the body, n the rate of spin in radians per second, N the rate of turning from position OX towards OY, the magnitude C of the couple is given by $C = InN$ in absolute units. Or if n and N are taken in revolutions per minute, we have $C = InN/2940$, C being now in engineers' lb. wt.-foot units.

Such gyrostatic couples are common in nature, and arise in every case where the direction of the axle of a rapidly rotating body undergoes alteration. Examples are seen in the turning of

a motor car (with its heavy flywheel) round a corner, the pitching of a steamer fitted with fore and aft turbines, the alteration of the line of flight of an aeroplane, the turning round of an electric crane having a rapidly rotating motor armature, the passage of a train with its many wheels round a curved railway track. In all these cases the above formula is applicable, and enables the magnitude of the forces involved to be calculated.

It will thus be seen that the simple experiments of spinning a top or an egg have as their basis one of the most important of dynamical principles, and one which must be carefully investigated in connection with many problems of practical engineering.

[A large number of experiments were shown to indicate the nature of the gyrostatic action set up in the cases mentioned in the paper and in others, and deductions were drawn as to the probable effects of such action.]

THE BOTANY OF THE KIMBERLEYS, NORTH-WEST AUSTRALIA,

By William Vincent Fitzgerald.

(Communicated by J. H. Maiden, I.S.O., F.R.S., Honorary Member.)

Note by Communicator. Mr. Fitzgerald was attached to two expeditions, viz., that of C. Crossland in 1905, and one in the following year. A note on the botanical work will be found in my "Notes on Acacia, No. li., Tropical Western Australia," in *Proc. Roy. Soc., N.S.W.* li., 106, 1917. The few specimens collected by Dr. House, collected on the F. S. Brockman expedition of 1901 are referred to, *op. cit.* p. 104, and are included by Mr. Fitzgerald in the present paper.

From time to time I brought before the Royal Society of New South Wales (Vols. xlvii., 221 (1913); xlix., 317, 318, (1915); li., 445 (1917)) notes on or descriptions of Eucalypts collected by Mr. Fitzgerald, embodying his notes or descriptions where available.

Concerning Acacia, the same remarks apply as regards tropical species, to my papers in *Proc. Roy. Soc., N.S.W.* li., 71 (1917) and "The Flora of the Northern Territory" (Ewart and Davies), published by the Federal Government, 1917, Appendix iv., Acacias, p. 318. As regards Extra-tropical species, *Proc. Roy. Soc., N.S.W.* li., 238 (1917).

On 11th April, 1916, I received from Mr. Fitzgerald, the day after his departure on active service, his M.S. on Western Australian plants, together with some herbarium specimens. With the author away from Australia (he recently returned wounded), I acted in his interests as well as I could. Some few remaining Eucalyptus notes I will continue to publish in the Royal Society, New South Wales, series of papers, and others in my Critical Revision of the genus.

A Hydrocharidiacea, which on receipt of the manuscripts I found Mr. Fitzgerald had described (but not published) had been forwarded by me to Dr. A. B. Rendle, F.R.S., of the British Museum, a specialist on this Family, as far back as July, 1915.

No opportunity presented itself of dealing with Mr. Fitzgerald's manuscripts in 1916. I divided them into three parts (a) The present portion, which deals with the tropical (chiefly Kimber-

ley) plants. This is by far the most valuable. I have re-arranged it but have not otherwise interfered with it. (b) Some notes on other Western Australian plants; valuable, but not so urgent. (c) Descriptions of Western Australian plants already published by Mr. Fitzgerald. It was evidently the intention of Mr. Fitzgerald to publish (a), (b), and (c) as a complete work, and this would have been very convenient. Of course no scientific journal would republish (c). It is regretted that the present paper was not published years ago, but financial difficulties apparently stood in the way.

During the last ten years I obtained a number of specimens of Mr. Fitzgerald's collecting by purchase from a former business partner of his. A few others I had received at odd times from Dr. Stoward, Botanist and Plant Pathologist of the Western Australian Department of Agriculture. In April, 1917, I received from Dr. Stoward specimens of 53 species now described in this paper. These are in the National Herbarium of Sydney, and the original set is with Dr. Stoward at Perth. Many of the species will have to be re-collected before material is available for other herbaria.

Mr. Fitzgerald's paper deals with one of the important *terrae incognitae* of Australia. This has been brought home to me frequently, as small collections from North-Western Australia are from time to time received. Accordingly, long before I became the trustee of Mr. Fitzgerald's manuscripts, I had prepared a botanical bibliography of the region, which is attached to my Acacia paper (*Journ. Roy. Soc. N.S.W.*, li., 71 (1917), the chief value of the purely botanical porton of which is based on Mr. Fitzgerald's material received from Dr. Stoward.

The following are proposed as new genera:—

CYPERACEÆ.
Crosslandia

MALVACEÆ.
Brockmania

The following are proposed as new species:—

CYCADACEÆ.
Cycas furfuracea

SCHEUCHZERIACEÆ.
Triglochin pterocarpa

GRAMINEÆ.
Eriachne pauciflora

CYPERACEÆ
Fimbristylis pilifera
Fimbristylis oligocephala
Fimbristylis arthrostyloides
Crosslandia setifolia
Scirpus Isdellensis
Rhynchospora affinis

HÆMADORACEÆ
Hæmadorum longifolium
Hæmadorum flaviflorum

PROTEACEÆ.
Grevillea miniata
Grevillea heteroneura
Grevillea erythroclada
Hakea Morrisoniana

LORANTHACEÆ.
Loranthus ferruginiflorus
Loranthus biangulatus

AMARANTACEÆ.
Ptilotus longistachyus
Ptilotus Johnstonianus

PORTULACACEÆ.
Calandrinia Tepperiana

LAURACEÆ.
Cassytha strigosa

LEGUMINOSÆ.
Cassia neurophylla
Cassia cladophylla
Jacksonia petrophiloides
Jacksonia aculeata
Crotalaria membranacea
Psoralea cuneata
Psoralea virens
Tephrosia conspicua
Tephrosia stipuligera
Atylosia lanceolata

ZYGOPHYLLEÆ.
Tribulus affinis
Tribulus curvicarpus

RUTACEÆ.
Boronia pauciflora

EUPHORBIACEÆ.
Euphorbia distans
Euphorbia comans
Euphorbia cinerea
Euphorbia chrysochaeta
Bridelia phyllanthoides
Petalostigma humilis
Phyllanthus polycladus
Mallotus Derbyensis

ANACARDIACEÆ.
Buchanania oblongifolia

RHAMNACEÆ.
Cryptandra intratropica

TILIACEÆ.
Triumphetta reflexa

MALVACEÆ.
Sida Hackettiana
Abutilon Andrewianum
Abutilon propinquum
Brockmania membranacea

STERCULIACEÆ.
Sterculia viscidula
Sterculia tuberculata
Sterculia viridiflora
Helicteres rhynchocarpa

LYTHRACEÆ.
Nesaea repens

COMBRETACEÆ.
Terminalia Hadleyana
Terminalia chlorocarpa
Terminalia biangulata
Terminalia Rogersii

MYRTACEÆ.
Melaleuca Crosslandiana
Melaleuca argentea
Melaleuca Loguei
Fenzlia phebalioides

EBENACEÆ.
Diospyros nitens

LOGANIACEÆ.
Mitrasacme lepidocalyx
Mitrasacme hispida

ASCLEPIADACEÆ.
Marsdenia Brockmaniana

BORRAGINACEÆ.
Ehretia urceolata
Heliotropium flaviflorum

SOLANACEÆ.
Solanum dioicum

SCROPHULARIACEÆ.
Stemodia flaccida

PEDALIACEÆ.
Josephinia papillosa

LENTIBULARIACEÆ.
Utricularia Charnleyensis

MYOPORACEÆ.
Pityrodia obliqua

CANDOLLEACEÆ.
Stylidium cordifolium
Stylidium rubiscapum
Stylidium irriguum
Stylidium claytonioides

GOODENIACEÆ.
Goodenia linifolia
Goodenia propinqua
Calogyne Heppleana
Scaevola scabrida
Scaevola stenostachya
Scaevola decipiens
Dampiera conospermoides

COMPOSITÆ.
Olearia aspera
Blumea pungens
Blumea prostrata
Pterocaulon globuliflorus

VARIETIES.

GRAMINEÆ.
Xerochloa imberbis R. Br. var. *repens.*

CYPERACEÆ.
Cyperus Holoschœnus R. Br. var. *viscida.*

MALVACEÆ.
Hibiscus zonatus F. v. M. var. *spinulosa.*

GOODENIACEÆ.
Goodenia lamprosperma F. v. M. var. *foliosa.*

COMPOSITÆ.
Pluchea tetranthera F. v. M. var. *cinerea*

His paper therefore contains descriptions of—

2 new genera
88 new species
5 new varieties

and from that circumstance also becomes a most important contribution to Australian botany. The new species of Acacia and Eucalypts are not included, having been dealt with elsewhere, as already stated. This would increase the number of species by at least six, making 94 in all.

It would be desirable to make a comprehensive statement in regard to the flora of North-West Australia, and my bibliography will be useful in this connection, but it is not desirable to increase the length of the present paper. In a few cases Mr. Fitzgerald has not given specific localities, and in cases in which a species occurs in extra-tropical areas, I have been careful to only present such of Mr. Fitzgerald's notes as refer, at least in part, to tropical specimens.

The Northern Territory and North-West Australia being contiguous country, it will be most instructive to compare Ewart and Davies' "Flora of the Northern Territory," published last month (December, 1917), with the present paper, but to do this would delay publication of Mr. Fitzgerald's paper, and would also raise the question of additional cost.

The following brief account of the physiograhpy of the area dealt with was supplied by Mr. Fitzgerald. The author has also some fuller notes on the geology of the region which are less in place in a purely botanical paper.

The part specifically detailed extends due east of King Sound and is typical of the country bounded on the south by the Fitzroy River.

The principal mountain chains are the King Leopold Ranges which bear west of north to Walcott Inlet. Mount Broome is the highest point, but does not exceed 1,900 feet above the north-eastern base. Away to the west and parallel with the ranges is a low rugged-looking one known as the Napier Range, and beyond, for a distance

of roughly 100 miles, when King Sound is reached, are a series of sandy, scrubby undulations and grassy plains. To the east of the King Leopold Ranges, looking from Mount Broome, the country in configuration consists of ranges and table-lands, with undulations, and extensive plains intervening, besides isolated mountains which rise above the surrounding country like islands from an ocean. The whole are intersected by numerous watercourses which, during the wet season, carry huge volumes of water, and always contain large permanent pools, or are running in part throughout the whole year. The elevations are faced by frequently unscalable cliffs of 50 to above 500 feet in height, whilst the rivers do not uniformly follow the base of the ranges, but instead often cut clean through them, forming wildly picturesque and precipitous gorges The following are some examples:—

River.	Ranges through which they gorge.
Lennard	King Leopold and Napier.
Isdell	Packhorse and Artesian.
Sprigg	Synnott.
Hann	Phillips.
Barker	Napier.

PTERIDOPHYTA.

FILICALES.

POLYPODIACEÆ.

1. *Adiantum* lunulatum Burm.
   King Sound District (Froggatt), Wingrah Pass, Napier Range (W.V.F.).
   Among limestone rocks.

2. *Aspidium* exaltatum Swartz.
   Sprigg, Charnley, and Hann Rivers, MacNamara Creek, base of Artesian Range, Edkins Range, Sunday Island (W.V.F.). In boggy spots.
   Rhizome creeping and fronds 4ft. long or caudex slender. 6–8ins. high, fronds to 3ft. long.

3. *Polypodium* phymatodes L.
   Sunday Island (W.V.F.).
   In shaded spots.

4. *Acrostichum* aureum L.
   Hamersley Range (McRae), King Sound District (Froggatt), Sunday Island (W.V.F.). In boggy spots.

5. *A.* scandens Smith.
   Sprigg and Charnley Rivers (W.V.F.). In wet spots.
   Rhizome trailing or climbing many yards.

PARKERIACEÆ.

6. *Ceratopteris* thalictroides Brong.
   Isdell, Adcock, Charnley Rivers, Woollybutt Creek (W.V.F.).
   Fronds form a thickened rhizome which is beneath water.

GLEICHENIACEÆ.

7. *Platyzoma* microphyllum R. Br.
   Cæspitose and forming patches of one or more feet across.
   Always found in sandy soil.

8. *Gleichenia* dichotoma Hook.
   Hunter's River, York Sound (A. Cunn), Charnley River, Lat. 16° 17′ (W.V.F.).
   1–2ft. in height. In wet spots among quartzite rocks.

SCHIZEACEÆ.

9. *Lygodium* scandens Swartz.
   Isdell, Sprigg, Hann, Charnley, and Calder Rivers, Sunday Island, Dillen's Springs (W.V.F.). Stems climbing many yards over scrub and small trees, and often attaining a height of 15–20ft.
   Among sandstone and quartzite boulders.

MARSILEACEÆ.

10. *Marsilea* angustifolia, R. Br.
Bases of Mts. House, Clifton, Hamilton, and Brennan (W.V.F.). In wet spots chiefly around billabongs.

LYCOPODIALES.

LYCOPODIACEÆ.

11. *Lycopodium* cernuum L.
Charnley River, Edkins Range (W.V.F.).
Among wet rocks.

SELAGINELLACEÆ.

12. *Selaginella* Belangeri Springer.
Isdell River, Mt. Bartlett, affluent of the Isdell River, eight miles N.W. of the Isdell Range (W.V.F.). In the clefts of wet rocks.

PSILOTALES.

PSILOTACEÆ.

13. *Psilotum* triquetrum Swartz.
Sprigg and Charnley Rivers (W.V.F.).
Rhizome shortly creeping ; spore-cases yellow. In moist spots.

GYMNOSPERMÆ.

CYCADALES.

CYCADEÆ.

14. *Cycas* furfuracea (W.V.F.), n. sp.
A palm-like plant with a simple stout trunk, leaves petiolate, the rhachises glabrous ; leaflets numerous, entire or rarely bifid, broad, linear, rigid and straight, ending in dark-coloured points, strongly keeled, margins somewhat recurved, glabrous above, invested beneath with a conspicuous furfuraceous indumentum, not decurrent on the rhachis, the lowest gradually smaller and passing into more or less scaly hairy straight spines which extend half-way down the petiole ; male cones shortly pedunculate, narrow-ovoid-deltoid, thickened at the apices, and terminating in stout obtuse upwardly curved points, the scales glabrous above, the acumen and antheriferous surface invested with a short dense brown woolly tomentum ; anther-cells covering the scale from the base to the thickened summit, carpophylls petiolate, with one to two pairs of ovules above the middle, densely ferruginous tomentose, blade ovate, prominently spinous-toothed, and terminating in a slender obtuse glabrous apex ; seeds globose, hard and glabrous,

Summits of Mts. Herbert, Broome, and Bold Bluff (W.V.F.).

Trunk 4 6ft. high. Leaves 2–2½ft. long, petioles ¼–½in; leaflets 6in. or less long by ¼in. broad. Male cones 1¼ft. long by 3in. diameter: scales 1in. or less in length, ½in. diameter: acumina ⅓in. long. Carpophylls 6–8in. long; stalk ¼in.: blade 1 1¼in. broad: apex 1–1½in. long. Seeds 1¼in. diameter, bluish purple and glaucous when young, yellow when mature. In sandy soil among sandstone and quartzite rocks.

Affinity to *C. media* R. Br.

15 *C.* media R. Br.

N.W. coast (A. Cunn.). Prince Regent's River. (J. Bradshaw and Allen.)

The description published in Flora Australiensis appears to be based on examples of more than one species.

CONIFERÆ

CUPRESSEÆ (ACTINOSTROBINÆ).

16. *Callitris* verrucosa R. Br.

A tree of 20–40ft.: trunk to 15ft.: diameter 1–1½ft.: bark grey, rough: timber brownish: branchlets and foliage often glaucous and then the cones are much more verrucose than in the ordinary form. "Cypress-pine."

In the western interior the species is most often found growing over calcareous rocks. Both the ordinary form and the glaucous one occur in tertiary limestone and sands, the latter in proximity to the sea.

var. *microcarpa* Benth.

York Sound, Prince Regent's River, Brunswick Bay (A. Cunn.). Summits of King Leopold, Packhorse, Isdell, Synnott, Artesian, Edkins, and Harding Ranges, and to the north; Mts. Harris, Barnett, and Bold Bluff: occasionally descending to their bases (W.V.F.).

Tree 30–80ft.; trunk to 40ft.; diameter 1½–2ft.: bark greyish, rugose; timber brown: cones small, slightly verrucose or quite smooth. In sandstone and quartzite country.

ANGIOSPERMÆ.

MONOCOTYLEDONEÆ.

PANDANALES.

TYPHACEÆ.

17. *Typha* angustifolia L.

Near Perth (Preiss), (W.V.F.); Rawlinson's Range (E. Giles); Bases of Mts. Brennan, Synnott, and Edkins Ranges (W.V.F.).

The tropical plant agrees with that of the Shaw River. The scapes are 4–8ft. in height.

PANDANACEÆ.

18. *Pandanus* odoratissimus L.
Stems erect, usually several together, attaining a height of 30ft., bi-tri-furcated near the summit ; fruits globular, 6–9in. long and in diameter, red when ripe. Reputedly an indication of fresh water. "Pandanus" or "Screw-pine."

19. *P.* aquaticus F. v. M.
Fitzroy, Isdell, Charnley, Denham, and King Rivers (W.V.F.).
Stem erect, 12–25ft. ; slender, emitting adventitious roots as in *P. odoratissimus* L., and inflorescence similar to those of that species ; drupes free, obovate to cuneate, dry and brown, mostly about 1in. long ; when old, splitting at the base into numerous fibres, the whole fruit forming a globose-ovate bead, 4–6in. long.

HELIOBIÆ (FLUVIALES).

POTAMOGETONACEÆ.

20. *Potamogeton* javanicus Hassk.
Isdell, Charnley, Calder, and Hann Rivers, MacNamara Creek (W.V.F.).
Leaves floating in still water.

NAJADACEÆ.

21. *Naias* tenuifolia R. Br.
Lennard, Isdell, Charnley, and Calder Rivers (W.V.F.).
In water and muddy localities.

APONOGETONACEÆ.

22. *Aponogeton* elongatus F. v. M.
Isdell and Charnley Rivers ; bases of Artesian, Synnott, Isdell and Edkins Ranges, and of Mt. Rason (W.V.F.).
In still water. The submerged leaves are linear-lanceolate, those floating, ovate-lanceolate and purplish beneath ; flowers yellow, in a thick ovate spathe.

SCHEUCHZERIACEÆ (JUNCAGINACEÆ).

23. *Triglochin* pterocarpa W.V.F. n. sp.
Roots tuberous ; leaves numerous, form a thickened base ; terete or semi-terete throughout, flaccid, the upper portion floating ; scapes terete almost as long as the leaves and bearing a spike-like raceme ; flowers numerous, on very short pedicels ; perianth-segments, 4–6, ovate or almost

orbicular ; anthers 6, all perfect ; carpels 3, quite free from the base ; not tapering upwards, all or 1–2 only ripening, the stigmas broad and slightly recurved ; fruit sessile or shortly stipitate, compressed ; oblong-lanceolate to lanceolate, falcate, terminating in a broad, usually straight beak, the inner and outer edges expanding into narrow longitudinal wings.

Isdell and Charnley Rivers (W.V.F.).

Leaves and scapes 2–5 or more feet in length. Inflorescence 4–12in. long, perianth-segments 1–1½in. long ; yellowish.

Fruits ¾in. long, yellow or purplish when ripe.

In still water.

Affinity to *T. procera*, R. Br.

ALISMATACEÆ.

24. *Alisma* oligococcum F. v. M.

King Sound District (Froggatt) ; Lennard and Barker Rivers (W.V.F.).

In still water, rooting in mud ; scapes 1–2ft. high ; flowers white.

HYDROCHARITACEÆ.

25. *Maidenia* rubra (W.V.F.) Rendle.

See ' "Maidenia" a new genus of Hydrocharitaceæ,' by A. B. Rendle, D.Sc., F.R.S., with a plate (Journ. Bot., Vol. 54, p. 313, Nov., 1916).

VALLISNERIEÆ.

26. *Vallisneria* spiralis L.

May, Meda, Lennard, Fitzroy and Isdell Rivers (W.V.F.) ; Margaret River (C. Andrews). The Margaret River here mentioned is in the South-West and not the tributary of the Fitzroy River known under that name.

GLUMIFLORÆ.

GRAMINEÆ.

ANDROPOGONEÆ.

27. *Andropogon* affinis R. Br.

Fraser Ranges (Dempster) ; Lennard, Fitzroy, Isdell, Hann, and Charnley Rivers (W.V.F.).

Cæspitose, reed-like, 6–8ft. in height.

In sandy loam and black soil.

28. *A.* procera R. Br.

Cæspitose. The lemon-thyme scented rhizomes are used by the aborigines of N.W. Australia in the preparation of an infusion which is drunk by them as a specific for colds, and reputedly has a beneficial effect.

In black soil and sandy loam.

29. *A.* brevifolius Swartz.
Goody-Goody, May, Meda, Lennard and Isdell Rivers (W.V.F.).
In sandy loam. This is the *A. fragilis* R. Br. of the Flora Australiensis.

30. *A.* axilis Hochsh.
May, Meda, Lennard, and Isdell Rivers (W.V.F.).
In black soil.

31. *Sorghum* halepense Persoon
W. Australia (Drumm) ; Port Hedland, Lennard and Fitzroy Rivers (W.V.F.).
In sandy loam.

32. *Dimeria* ornithopoda Trinius.
Eastern base of Bold Bluff (W.V.F.).
In moist black soil. This is the *D. tenera* Trin. of the Flora Australiensis.

33. *Rottboellia* ophiuroides Benth.
Lennard, May, and Isdell Rivers (W.V.F.)
A reed-like grass, 6–8ft. in height. In sandy loam.

34. *Ischaemum* laxum, R. Br.
Lennard and Isdell Rivers (W.V.F.).
In black soil.

35. *Anthistiria* imberbis Retz.
May, Meda, Lennard, Barker, Fitzroy, Richenda, Yeeda, Traine, Adcock, Throssell, Hann, Barnett, Isdell, Sprigg, Charnley, Calder, Ord, Denham, and King Rivers ; Valentine, Bell, Synnott, Station, Messmate, Manning, Harris, McNamara, and Dingo Creeks ; Dillen's Springs, Cygnet Bay (W.V.F.).
The "Bundle-Bundle," one of the best of fodder grasses. *A. australis* R. Br., is now referred to this species. Bentham, in the Flora Australiensis, placed both under the annual *A. ciliata* L.
In black soil.

36. *A.* membranacea Lindley.
This is the "Flinders grass" of N.W. Australia, and is one of the best of fodder plants.

37. *Imperata* arundinacea Cyrillo.
Murchison River (Oldfield) ; Walcott Inlet, mouth of Calder River (W.V.F.).
Cæspitose, in black sandy soil.

ZOYSIEÆ.

38. *Perotis* latifolia Aiton.
Fitzroy River and Margaret Creek (Calvert's Exped.); Broome; Derby; May, Lennard, and Fitzroy Rivers (W.V.F.).
In sandy soil. Includes *P. rara* R. Br.

TRISTEGINEÆ.

39. *Arundinella* brasiliensis Raddi.
Prince Regent's River (J. Bradshaw and Allen); Lennard, Isdell, Barnett, Charnley, and Calder Rivers (W.V.F.).

PANICEÆ.

40. *Paspalum* longiflorum Retz.
Isdell, Hann, and Barnett Rivers (W.V.F.).
In deep black soil or sandy loam.

41. *P.* scrobiculatum L.
Prince Regent's River (J. Bradshaw and Allen); Wingrah Pass, Napier Range, Lennard, Fitzroy, and Isdell Rivers (W.V.F.).
In wet sandy spots.

42. *Panicum* crus-galli L.
Swan River (Helmich); Port Hedland; May River (W.V.F.).
In sandy spots.

43. *P.* indicum L.
Prince Regent's River (J. Bradshaw and Allen); Lennard and Isdell Rivers (W.V.F.).
In sandy loams.

44. *P.* majiusculum F. v. M.
Durack River (J. Bradshaw and Allen); Lennard, Isdell, and King Rivers (W.V.F.).
In heavy black soil.

45. *P.* rarum R. Br.
Isdell and Barnett Rivers; north base of Bold Bluff (W.V.F.).
In moist black soil. A gibbosity at the base of the palea.

46. *P.* colonum L.
Lennard, Fitzroy, and Isdell Rivers (W.V.F.).
In sandy loam.

47. *P.* myosuroides R. Br.
North and east base of Bold Bluff (W.V.F.).
In moist black soil. A form reduced in all its parts.

48. *P.* repens L.
Isdell River, east base of Bold Bluff (W.V.F.).
In moist black soil.

49. *P.* bicolor R. Br.
Lennard, Isdell, and Charnley Rivers (W.V.F.).
In black and sandy loams.

50. *P.* polyphyllum R. Br.
May, Meda, Lennard, Fitzroy, Barker, and Isdell Rivers (W.V.F.).
In moist sandy loam. Spikelets silky ; no palea within the 3rd glume ; panicle broad with filiform pedicels.

51. *Setaria* macrostachya H. B. et K.
Gascoyne River (Polak) ; Wingrah Pass, Napier Range, Lennard and Isdell Rivers ; Packhorse Range, Wyndham (W.V.F.).
Among rocks and in their crevices.

52. *Pennisetum* arnhemicum F. v. M.
King Sound District (Froggatt) ; Wingrah Pass, Napier Range, Lennard River (W.V.F.)
In moist sandy soil.

53. *P.* compressum R. Br.
Fitzroy River, above Upper Liverynga Station (W.V.F.).
In black soil.

54. *Chamaeraphis* spinescens Poiret.
Fortescue River (J. Forrest) ; Fitzroy River (W.V.F.).
In wet black soil.
Var. *parvispicula* Benth.
May, Meda, Lennard, Isdell, Barnett, and King Rivers (W.V.F.).
Stems running many yards in water. "Water-grass"—The specimens are very close to *C.* gracile Hackel.

55. *Xerochloa* imberbis R. Br.
Cygnet Bay (A. Cunn.) ; King Sound District (Froggatt) ; near Derby ; Cygnet Bay (W.V.F.).
In dry sandy soil.
Var. *repens* W.V.F.
Goody-Goody, nine miles from Derby (W.V.F.).
Stems creeping and rooting at the nodes ; rhachises muricate ; spikelets smaller than those of the typic plant.

56. *X.* barbata R. Br.
May, Meda, Lennard, and Fitzroy Rivers ; Broome (W.V.F.).
In sandy loam.

ORYZEÆ.

57. *Oryza* sativa L.
May, Meda, Lennard, and Isdell Rivers (W.V.F.).
Cæspitose. 4–6ft. in height. "Wild Rice." In sandy spots.

AGROSTIDEÆ.

58. *Aristidea* hygrometrica R. Br.
Lennard, Fitzroy, Barker, Hann, and Isdell Rivers (W.V.F.).
Cæspitose, in sandy soil. Regarded as a pest. The seeds sometimes cause the death of stock by penetrating the entrails from outside of the body.

59. *Sporobolus* tremulus Kunth.
May, Lennard, and Isdell Rivers (W.V.F.).
The specimens differ from the type in large, not rigid, flat leaves, and more open panicle. In moist sandy soil.

AVENEÆ.

60. *Eriachne* ciliata R. Br.
Between De Grey River and La Grange Bay (Alex. Forrest); Lennard, Barker, and Isdell Rivers (W.V.F.).
In dry sandy spots.

61. *E.* pauciflora W.V.F. n. sp.
Rhizome perennial, shortly creeping and somewhat knotted, woolly, tomentose; stems erect or ascending; filiform, and along with the leaves, silky; hairy, the nodes barbellate; leaves chiefly basal, narrow, often almost setacous, convolute, finely pointed, erect, shorter than the stems, the outer ones reduced to broad mucronate-acute sheaths; ligula barbellate; spikelets 1–3, pedicellate; outer glumes acute, 7–9, curved, thin, purplish, keeled, glabrous or rarely scantily hirsute along the keel, margins often scabrous; flowering glume slightly shorter, narrow densely silky-pubescent and terminating in a fine curved awn; palea silky-hairy, with two prominent nerves on each side and tapering into a rather long rigid fruit.
Edkins Range (W.V.F.).
Stems, including the inflorescence, not exceeding 4ins. in height. Pedicels 2in. or less. Outer glumes $2\frac{1}{2}$ 1in. long. Awns $\frac{1}{2}$–$\frac{3}{4}$in.
In sandy soil. The species probably attains greater dimensions than already detailed. All grains in the specimens are diseased, they being filled with black granules which have caused them to assume an oblong-cylindrical form, black in colour with longitudinal whitish stripes or pure black. They attain a length of two lines.
Affinity—*E.* squarrosa R. Br.

62. *E.* festucacea F. v. M.
Careening Bay (A. Cunn.); Isdell, Charnley, and Calder Rivers (W.V.F.).
In sandy loam.

63. *E.* pallida F. v. M.
Dampier's Archipelago (Walcott); Lennard, Fitzroy Rivers (W.V.F.).
In black or sandy loam.

64. *E.* melicacea F. v. M.
Lennard and Isdell Rivers (W.V.F.).
In sandy soil.

FESTUCEÆ.

65. *Phragmites* communis Trinius.
The tropical western plant varies from 8- 10ft. in height.

66. *Elythrophorus* articulatus Beauvois.
Fortescue River (J. Forrest); Lennard, Fitzroy, and Isdell Rivers (W.V.F.).
In black soil.

67. *Eetrosia* Schultzii Benth.
May, Lennard, Fitzroy, Barker, Isdell, Hann, and Barnett Rivers (W.V.F.)
Spikelets from plate to purplish, flowers usually two. In black or sandy loams.

68. *Eragrostis* pilosa Beauvois.
Gascoyne River (Polak); Lennard and Fitzroy Rivers (W.V.F.).
In sandy loam.

69. *Triraphis* pungens R. Br.
10 miles above Wingrah Pass, Lennard River, Isdell, and King Rivers (W.V.F.). Leaf-sheaths often viscid.
In dry sandy spots.

70. *Triodia* Mitchelli Benth.
Upper Ashburton and between the Lyons and Fortescue Rivers (H. S. King); Lennard, Isdell, Hann, Denham, and King Rivers (W.V.F.).
Among sandstone or quartzite rocks.

71. *T.* Cunninghamii Benth.
Cambridge Gulf (A. Cunn.); Isdell, Charnley, Calder, Sprigg, and Barnett Rivers; elevations between the Ord, Denham, and King Rivers, Dillen's Springs (W.V.F.).
Among sandstone or quartzite rocks.

72. *T.* microstachya R. Br.
N.W. Coast (A. Cunn.); Broome; Cygnet Bay (W.V.F.).
In sandy soil.

CHLORIDEÆ.

73. *Cynodon* tenellus R. Br.
Fitzroy River and near Margaret River (Calvert's Exped.); near Derby; May River (W.V.F.).
In sandy loam.

74. *C.* convergens R. Br.
North base of Bold Bluff (W.V.F.).
Spikes sometimes four. In moist grassy spots.

CYPERACEÆ.

75. *Cyperus* pygmaeus Rottb.
Meda, May, Lennard, Fitzroy, and Isdell Rivers (W.V.F.).
An *Isoetopsis*-like plant ; in muddy spots.

76. *C.* cuspidatus H.B. et K.
Lennard, Isdell, and King Rivers, Hillgrove Station (W.V.F.).
In sandy soil.

77. *C.* flavescens L.
Denham and King Rivers (W.V.F.).
A slender tufted annual of 1ft. high ; nuts more than $\frac{3}{4}$ the length of the glumes.
In moist grassy spots.

78. *C.* albo-marginatus Nees.
Lennard, Isdell, and King Rivers (W.V.F.).
In damp grassy spots.

79. *C.* fulvus R. Br.
Gascoyne River (Polak) ; Lennard, May and Fitzroy Rivers (W.V.F.).
In moist black soil.

80. *C.* trinervis R. Br.
Lennard, Fitzroy, Isdell, Barnett, Charnley Rivers, and base of Inglis' Gap, King Leopold Ranges (W.V.F.).
In moist grassy spots.

81. *C.* distans L.
Lennard, Isdell, Ord Rivers (W.V.F.).
On grassy and sandy flats.

82. *C.* holoschoenus R. Br.
Near Derby, May, Meda, Lennard, Fitzroy, Isdell, Ord, Denham and King Rivers ; Knob Hill ; base of Mt. Robb. (W.V.F.).
In sandy soil.
Var. viscida, W.V.F.
Summit of Mt. Leake, Lady Forrest Range (W.V.F.).
In crevices of quartzite rocks. Differs from other forms in the whole plant being very viscid.

83. *C.* sporobolus R. Br.
N.W. coast (A. Hughan), Isdell River (W.V.F.).
Remarks.—Rhizome bulbous ; nuts black. On a sandy ridge.

84. *C.* squarrosus L.
Dampier's Archipelago (Walcott); Fortescue River (J. Forrest); Fitzroy, Lennard, Denham and King Rivers, and Hillgrove Station; near the last named (W.V.F.).
In sandy and stony spots.

85. *C.* haspan L.
Brunswick Bay. (A. Cunn.); Isdell and King Rivers (W.V.F.).
In moist sandy soil.

86. *C.* rotundus L. var. *pallidus* Benth.
Near Broome and Derby, May and Meda Rivers (W.V.F.).
In dry sandy spots.

87. *C.* polystachyus Rottb.
Hamersley Range (McRae) Ord, and King Rivers (W.V.F.).
In sandy spots.

88. *Heleocharis* variegata Kunth.
Adcock, Isdell, Hann, Charnley and King Rivers (W.V.F.).
In sandy or muddy spots or in shallow pools.

89. *H.* atropurpurea Kunth.
Lennard, Isdell, Denham and King Rivers (W.V.F.).
In wet sand.

90. *Fimbristylis* acicularis, R. Br.
Lennard, Isdell, Charnley, Denham and King Rivers. (W.V.F.).
In damp grassy spots.

91. *F.* pilifera (W.V.F.) n. sp.
A tufted annual with the leaves, stems, and outer bract-like glumes invested with short white hairs; stems filiform, few to many from each stock, the whole surrounded by several narrow-lanceolate or broad linear leaves, which are usually longer than the stems; stem-leaves reduced to 2–3 loose sheathing scales, the upper terminating in setaceous points of $\frac{1}{4}$–$\frac{1}{2}$in. long; spikelet solitary, erect or slightly nodding, herbaceous, somewhat compressed; glumes few, imbricate on all sides, 2 outer ones 2/3 as long as the spikelet, green in the centre and 5-nerved, obtuse, margins membranous, 3rd one similar, all flowerless, the flowering glumes 4–6, membranous, with green centres; stamens 3, style somewhat flattened, almost or quite glabrous, much longer than the nut, 2-branched, the branches considerably shorter than the entire part; nut obovate, biconvex, with 6–9 strong transverse ridges. Base of Bold Bluff; Isdell, Charnley and Calder Rivers (W.V.F.).
Stems 1–4in. high. Spikelets $3\frac{1}{2}$ lines long by $1\frac{1}{2}$ lines broad. Nuts 1 line long, shining brown.
In moist grassy spots.
Affinity, *F* acuminata, Vahl.

92. *F.* cardiocarpa F. v. M.
Near Derby, Meda, Lennard and Isdell Rivers ; Sunday Island (W.V.F.).
Stamens and style-branches 3 each.
In dry sandy or black loamy soil.

93. *F.* tetragona R. Br.
Beagle Bay (Alex. Forrest) ; May, Lennard and Isdell Rivers (W.V.F.) Style-branches 3.
In sandy soil.

94. *F.* aestivalis, Vahl.
Denham and King Rivers (W.V.F.).
In moist black soil.

95. *F.* diphylla Vahl.
Hillgrove Station, King River (W.V.F.).
A hirsute form attaining a height of over 3ft. ; leaves often 2 lines broad.
In wet sandy spots.

96. *F.* denudata R. Br.
Ord, Denham and King Rivers. (W.V.F.).
In damp sandy spots.

97. *F.* caespitosa R. Br.
Lennard, Isdell and Charnley Rivers (W.V.F.).
In rather dry sandy loam.

98. *F.* capillaris Asa Gray.
Western Australia (Drumm.) ; Blackwood River (W.V.F.).
On damp grassy flats.

99. *F.* miliacea Vahl.
Near Derby ; Goody Goody, May, Meda, Lennard, Fitzroy, and Isdell Rivers. (W.V.F.). Leaves broader than those of the type.
In sandy soil.

100. *F.* ferruginea Vahl.
Murchison River (Oldfield) ; Lennard, Ord, and Denham Rivers ; Sunday Island (W.V.F.).
In sandy soil.

101. *F.* pterygosperma R. Br.
Lennard, Fitzroy, Isdell, Charnley and Ord Rivers. (W.V.F.).
In sandy spots.

102. *F.* rara R. Br.
Lennard, Isdell, Denham Rivers (W.V.F.).
In moist sandy or black soil.

103. *F.* sphaerocephala Benth.
Camden Harbour (J. Martin) ; Isdell River, Packhorse Range (W.V.F.)

In moist sandy loam.

104. *F.* capitata R. Br.
Isdell River, Packhorse Range, east base of Bold Bluff (W.V.F.). Besides typical specimens, there are some with 1–3 proliferous branches.

In moist sandy loam.

105. *F.* oligocephala (W.V.F.) n. sp.
An annual with hardly any rhizome ; stems tufted, somewhat compressed, striate, or obtusely angular, slender, glabrous or slightly scabrid upwards ; radical leaves linear, flaccid, glabrous, with short open sheaths, those on the lower portion of the stems reduced to obtuse sheathing scales, more or less barbellate at the orifices ; heads of spikelets depressed-globose, usually terminal, but the inflorescence often proliferous and emitting 1–2 short branches, each bearing heads similar to the primary one ; spikelets 5–10, 5–7 flowered, ovate, the subtending bract solitary, shorter than or equalling the spikelets, bordered upwards by membranous wings which terminate in divaricate obtuse lobes, the apex of the bract ending in a rigid obtuse point equalling the lobes ; glumes loosely imbricated, 1–2 of the lower ones flowerless, carinate, the keel green, and very prominent and terminating in a short rigid mucro, the sides of a rich brown, nerveless, and terminating in 2 obtuse lobes beyond the mucro, hispid on the keel and sides, the margins ciliate with short white spreading hairs ; stamens 3, the anthers tipped with white globular appendages ; style terete or slightly flattened, glabrous, 3-branched, the branches as long as the entire portion ; nut small, broadly-obovate, obtusely triangular, tuberculate. Packhorse Range (W.V.F.).

Stems 6–9in. high. Leaves 9in. long or less. Head of spikelets $\frac{1}{3}$in. diam. Proliferous branches $\frac{1}{2}$-1in. long. Spikelets 2 lines long, $1\frac{1}{2}$ line broad. Nuts greyish and shining.

In moist sandy loam along the banks of creeks.
Affinity to *F.* capitata, R. Br.

106. *F.* quinquangularis Kunth.
Lennard and Isdell Rivers. (W.V.F.).

In wet sandy spots.

107. *F.* solidifolia F. v. M.

Derby ; Goody Goody, May, Meda, Lennard, Fitzroy, Hann Rivers (W.V.F.).

On dry sandy rises.

108. *F.* microcarpa F. v. M.

Goody Goody, May, Meda, Lennard, Fitzroy, and Ord Rivers (W.V.F.).

On dry sandy rises.

109. F. barbata Benth.

Dampier's Archipelago (Walcott) N.W. coast (Alex. Forrest) ; Sunday Island ; Broome (W.V.F.).

In sandy spots.

110. *F.* arthrostyloides (W.V.F.) n. sp.

Rhizome thick and short, the roots woolly-tomentose ; stems leafless and densely tufted, erect, slender, 5-angled, very scabrous, with scattered setulose bristles ; sheathing scales bristly-hairy, the basilar ones membranous, broadly lanceolate, terminating in short subulate points ; cauline sheaths near the base, few, terminating in filiform points of $\frac{1}{2}$in. or less in length ; spikelets 1-flowered, 1 to several, sessile in a terminal head, each spikelet ovate, glabrous or slightly pubescent ; outer bracts several, 2 quite or nearly as long as the spikelets, lanceolate subulate, margined by long bristly hairs, those subtending each spikelet gradually passing into the glumes ; glumes 3 -4 only ; inner flowering glume conspicuously keeled, obscurely 5–7 nerved, ovate-lanceolate, the 2nd the longest, the others gradually smaller, lanceolate, acute, keeled, obscurely 7-nerved ; flowers hermaphrodite, stamens 3 ; filaments short ; anthers linear terminating in almost acute white tips ; style compressed, glabrous, much thickened at the base, conspicuously articulate on the nut and deciduous at the articulation after flowering ; style-branches 3, recurved, simply stigmatic or slightly plumose, as long as or slightly longer than the entire portion of the style ; nut ovate, globose, obtusely triangular, on a short thick stipes, tuberculate. Artesian Range (W.V.F.).

Stems $1\frac{1}{2}$–2ft. high. Sheathing scales reddish-brown.

Spikelets 3–4 lines long, brown. Anthers nearly 2 lines long, yellow. Nuts above 1 line long, white.

Among sandstone and quartzite rocks. The species is separated from Section Abildgaardia of Fimbristylis by the 1-flowered spikelets. It closely approaches *Arthrostylis*, R. Br.

Crosslandia (W.V.F.) n. gen.

Flowers monoecious. Male spikelets capitate, on filiform stems. Glumes imbricate, all flowering. Female spikelets solitary or in twos or threes at the base of the leaves. Glumes few, slightly imbricate. No hypogynous bristles. Nut and style as in *Fimbristylis*. Stems leafy at the base. Differs from *Fimbristylis* in the spikelets being monoecious and in the position and structure of the female spikelets. This is named out of compliment of Mr. Charles Crossland, who was in charge of the Trigonometrical Survey Expedition to Kimberley in 1905, of which the author was a member.

111. *C.* setifolia (W.V.F.) n. sp.

A tufted annual with a short stock ; stems several, filiform, almost terete, sulcate, scabrous upwards, bearing a depressed-globular head of male-spikelets, the head subtended by 8 or more narrow-lanceolate rigid bracts, the outer generally strongly tri-nerved, and 1-2 usually exceeding the spikelets ; leaves numerous, radical, surrounding but not adherent to the stems, setaceous, rather rigid, almost half the length of the stems, scabrous, with short, broad, striate, open, hyaline, margined sheaths, those on the stems reduced to 1–2 open mucronate sheaths, the radical female spikelets very numerous and imparting to the stock a bulbous appearance ; male spikelets 10-12, rather closely packed, glumes 8–10, all flowering, boat-shaped, with a prominent green keel which terminates in a short mucro, sides thin, pale-brown, minutely scabrous ; stamens 3, or in the upper flowers, 2 only ; ovary and style rudimentary ; female spikelets 3 or fewer together, closely sessile outside or slightly intermixed with and always at the base of the leaves ; spikelets 2–5 flowered, much narrower upwards ; glumes, excepting the lowest short one, all containing flowers, narrow, membranous with prominent greenish middle, ending in long hair-like points, finely hirsute, style filiform, glabrous, or slightly silky, the branches 3, occasionally 4, as long as the entire portion ; base of the style pyramidal-triangular, articulate on the ovary, nut narrow-obovate, not compressed, with 3–4 conspicuous longitudinal ribs hispid and densely minutely tuberculate.

Goody Goody, 9 miles from Derby (W.V.F.).

Stems 3–8in. high. Leaves $1\frac{1}{2}$–4ins. long. Male-spikelets 3 lines long, $1\frac{1}{2}$in. broad. Female spikelets $\frac{1}{3}$–$\frac{1}{2}$in. long, and comparatively narrow. Style $\frac{1}{2}$in. long. Nuts 1 line long, brown.

In dry sandy spots. The plant bears a close resemblance to some of the capitate *Schoeni*. The long membraneous glumes of the female flowers, along with the protruding style branches, cause the leaves to appear as if surrounded by bracts with reddish filamentose apices.

112. *Scirpus* isdellensis (W.V.F.) n. sp.

Roots fibrous or shortly creeping ; stems filiform, floating in water ; leaves reduced to a solitary sheathing scale at the base of the stem ; spikelets 2, each 2 3 flowered, but usually perfectly only 1 nut, subterminal (the stem terminating in a glume-like point much shorter than the spikelets) ; spikelets narrow-ovate ; glumes obtuse, keels prominent and green, the sides not striate and varying from a pale brown to a dark reddish brown ; hypogynous bristles 6, unequal, the longest about as long as the nut, retrorsely scabrid ; nut nearly as long as the glume, obovate, minutely striate, prominently 3-angled, terminal callosity much thickened and prominent ; style-branches 3, free almost to the base ; stamens 2 ; anthers apiculate. Upper Isdell River (W.V.F.).

Stems 2, 6ins. long. Spikelets mostly under 1 line long. Nuts brownish.

Always in running water.

Affinity. *S.* riparius. Sprengel.

113. *S.* erectus Poiret.

Isdell, Charnley, Calder, Lennard Rivers. (W.V.F.) In damp spots. The *S.* debilis Pursh.

114. *S.* supinus L.

Fortescue River (J. Forrest) ; Fitzroy, Hann and Isdell Rivers. (W.V.F.).

In moist sandy spots.

Var. *uninodis*, Benth. (not so indicated in Flora Australiensis. J.H.M. Presumably after *Scirpus uninodis* Boiss. J.H.M.)

Lennard, Isdell, Charnley, and Calder Rivers (W.V.F.).

In wet sand.

115. *S.* articulatus L.

Isdell, Charnley and Calder Rivers. (W.V.F.)

In muddy spots.

116. *S.* mucronatus L.

Isdell and Charnley Rivers. (W.V.F.)

In wet sandy soil.

117. *Lipocarpha* microcephala R. Br.

Fortescue River (J. Forrest) ; Lennard, Isdell and King Rivers (W.V.F.).

In sandy loam.

118. *Fuirena* glomerata Lamarck.

Isdell and Charnley Rivers (W.V.F.).

In wet spots.

119. *Rhynchospora* affinis (W.V.F.) n. sp.

An annual, stems 1–3 together, rather stout, trigonous and striate ; leaves nearly all basal, narrow, with loose open, glabrous or scarcely ciliate sheaths, the inner with a closed sheath, the laminae often longer than the stem ; spikelets numerous, capitate, involucral bracts spreading, narrow, all with dilated ciliate bases ; spikelets very narrow and almost acute, 2–3 outer glumes much shorter and powerless ; hypogynous bristles six, three nearly equalling the glume and three somewhat shorter, all much longer than the nut, scabrid with upward pointing teeth ; nut narrow-oblong, biconvex, beak half the length of the nut, narrow-conical, the broad base not contracted nor decurrent along the margins of the nut.

Base of Inglis' Gap, King Leopold Ranges. (W.V.F.).

Stems 4-8ins. high. Heads of spikelets $\frac{3}{4}$in. diameter. Involucral bracts 3in. or less in length. Spikelets 5 lines long, pale-shining brown.

In moist grassy spots.

Affinity. *R.* longisetis R. Br.

120. *Schoenus* falcatus R. Br.

Isdell, Sprigg and Charnley Rivers (W.V.F.).

In sandy soil among sandstone and quartzite rocks.

121. *S.* punctatus, R. Br.

Isdell and Charnley Rivers. (W.V.F.).

In sandy soil.

122. *Scleria* rugosa R. Br.

Packhorse Range ; Isdell River (W.V.F.).

In dry sandy spots.

123. *S.* Brownii Kunth.

Artesian and Edkins Ranges ; Isdell, Charnley and Calder Rivers. (W.V.F.).

In sandy soil and in the clefts of sandstone and quartzite rocks.

PRINCIPES.

PALMÆ.

124. *Livistona* Alfredi F. v. M.

Millstream, Fortescue River (Alex. Forrest) ; Mts. Herbert, Broome, Leake and Barnett ; Isdell, Harris and Phillips Ranges ; hills near the junction of Hann and Barnett Rivers (W.V.F.). Trunk 40 60ft. in height ; diameter, 1ft. The "Fan-palm" or "Cabbage-palm" of Kimberley. Among sandstone and quartzite rocks. F. S. Brockman and J. Bradshaw have reported the existence of another species between Wyndham and the West coast.

The trunk is never above 10ft. in height. It is probably identical with *L.* Leichhardtii, F. v. M.

SPATHIFLORÆ.

ARACEÆ.

125. *Typhonium* angustilobium, F. v. M.

King Sound District (Froggatt) ; Lennard River, near Inglis' Gap, King Leopold Ranges. (W.V.F.).

In good soil, in damp depressions.

LEMNACEÆ.

126. *Lemna* trisulca, L.

Ord and Denham Rivers and lagoons in their vicinity ; Parry's Creek (W.V.F.).

FARINOSÆ.

127. *Flagellariá* indica L.

East of Oscar Range (Alex. Forrest) ; Prince Regent's River (J. Bradshaw and Allen) ; Sunday Island, Point Cunningham, Cygnet Bay, Swan Point (W.V.F.). Climbing to 30ft. ; flowers pale yellow, fruits red. The aborigines use the stems for many purposes in lieu of bamboos.

CENTROLEPIDAEÆ.

128. *Centrolepis* Banksii Roem. et Schult.

Isdell and Charnley Rivers (W.V.F.). A small form growing in wet spots.

129. *C.* exserta Roem. et Schult.

Isdell, Charnley, Calder and Sprigg Rivers ; north base of Bold Bluff (W.V.F.). Bracts hispid with long white spreading hairs ; scales longer than the bracts ; edges of the bracts, the filaments, and styles scarlet.

In wet soil.

XYRIDACEÆ.

130. *Xyris* complanata, R. Br.
N. W. coast (Alex. Forrest) ; north base of Bold Bluff ; Isdell and King Rivers ; Dillen's Springs (W.V.F.).
Cæspitose, in wet spots. Flowers yellow.

131. *X.* pauciflora Willd.
Upper Isdell River, Charnley River (W.V.F.).
Leaves broad. In wet soil.

ERIOCAULACEÆ.

132. *Eriocaulon* quinquangulare L.
Isdell and Adcock Rivers (W.V.F.).
In wet spots. Originally recorded as indigenous in Australia on a solitary specimen found at Keekwich Springs, in the Northern Territory.

133. *E.* nigricans R. Br.
Isdell River, Bell Creek, Inglis' Gap (W.V.F.).
In damp spots.

134. *E.* cinereum R. Br.
Lennard and Isdell Rivers (W.V.F.).
In moist sandy soil.

135. *E.* setaceum L.
Woodhouse River (J. Bradshaw and Allen) ; Woollybutt Creek, base of Mt. Rason, Artesian and Edkins Ranges, Isdell, Charnley, and Calder Rivers (W.V.F.).
In running water.

COMMELINACEÆ.

136. *Cartonema* spicatum R. Br.
Woodhouse and Carson Rivers (J. Bradshaw and Allen) ; Isdell River, Woollybutt Creek (W.V.F.).
On grassy plains.

PONTEDERIACEÆ.

137. *Monochoria* cyanea F. v. M.
King Sound District (Froggatt) ; in lagoons (billabongs), alongside of Lennard, Fitzroy, Barker, Isdell, and Adcock Rivers ; bases of Mts. House and Clifton (W.V.F.).
Rooting in mud ; stems floating for many feet ; flowers bright blue.

PHILYDRACEÆ.

138. *Philydrum* lanuginosum Banks.
Isdell, Charnley, and Calder Rivers (W.V.F.).
In and alongside still water.

LILIIFLORÆ.

JUNCACEÆ.

139. *Xero'es* elongata Benth.
Isdell River, base of Table-top Mountain, base of Mts. Rason and Daglish, Calder River (W.V.F.).
Cæspitose ; flowers yellow. In sandy soil.

LILIACEÆ.

140. *Rhipogonum* album R. Br.
Charnley River, Artesian and Edkins Ranges (W.V.F.).
Among sandstone and quartzite rocks.

141. *Dianella* cœrulea Sims.
Upper Isdell River (W.V.F.).
Cæspitose in sandy soil.

142. *Iphigenia* indica Kunth.
Summit of Mt. Rason (W.V.F.).
Bulbous. Among quartzite rocks.

143. *Thysanotus* chrysantherus F. v. M.
Durack River (J. Bradshaw and Allen) ; north base of Bold Bluff, Isdell, Charnley, Calder and Barnett Rivers (W.V.F.).
Roots thickened, scarcely or not tuberous ; flowers bluish-red ; seeds black ; shining and pitted. In moist grassy spots.

144. *Asparagus* racemosus Willd.
Of rambling habit or climbing many feet.

HÆMODORACEÆ.

145. *Haemodorum* longifolium W.V.F. n. sp.
Rootstock bulb-like, with thick woolly-tomentose roots ; stems stout, usually tall, branched from about the middle ; leaves long-linear, rigid, somewhat glaucous, with long open sheaths, the laminæ flat, obtuse, with numerous striations, the stem-leaves gradually shorter ; panicle large, with spreading branches, the ultimate ones bearing loose few-flowered racemes ; bracts and bracteoles subacute ; outer segments of the perianth broad to narrow-lanceolate, obtuse, rather thick, the inner ones oblong-lanceolate and one-eighth or less longer than the outer ; stamens equalling the outer perianth-segments, the anthers as long as the filaments ; ovary inferior, capsule half-superior, conspicuously didymous.
Upper Isdell River, near Synnott Range, Dillen's Springs (W.V.F.).

Plant 2–4ft. in height. Leaves from $2\frac{1}{2}$ to above $3\frac{1}{2}$ft. long. Bracts and bracteoles $1\frac{1}{2}$-2 lines long. Pedicels 2-$2\frac{1}{2}$ lines long. Perianth 2-$2\frac{1}{2}$ lines long, dark-red. Capsule above $\frac{1}{2}$in. in diameter.

In moist sandy loam.

Affinity, *H.* coccineum R. Br.

146. *H.* flaviflorum W.V.F. n. sp.

Stems form a thickened base, branched from about the middle or above; basal leaves linear-terete, striate, frequently longer than the stem, upper ones very few and short; inflorescence a loose few-branched panicle, the ultimate slender branches terminating in loosely flowered racemes; bracts and bracteoles obtuse or subacute; perianths yellow, occasionally greenish-yellow, all on short pedicels, the outer segments oblong-lanceolate, the inner narrower, all obtuse and of equal length; stamens as long as the perianth, the anthers equalling the filaments; ovary half-superior.

Edkins Range (W.V.F.).

Total height of plant 2ft. or less. Leaves $2\frac{1}{2}$ft. long or shorter. Racemes 1–2in. long. Bracts and bracteoles mostly about 2 lines long. Perianths 2 lines long. Capsule not seen.

In sandy loam.

Affinity, *H.* parviflorum Benth.

147. *H.* parviflorum Benth.

Brunswick Bay (A. Cunn.); near Derby, Goody Goody, Sunday Island (W.V.F.).

Lower leaves longer than the scapes; flowers scarcely $1\frac{1}{2}$ lines long, dark-purple; stamens as long as the perianth-segments. In damp sandy spots.

AMARYLLIDACEÆ.

148. *Crinum* asiaticum L.

King River (W.V.F.).

In wet soil.

MICROSPERMÆ.

ORCHIDACEÆ.

149. *Cymbidium* canaliculatum R. Br.

Epiphytal on various species of Eucalyptus, especially E. clavigera, A. Cunn. Sepals greenish-yellow without, yellow on the margins, very dark-red within; petals greenish-yellow, saturated with very dark-red; column pale-coloured, profusely streaked and blotched with reddish purple; base of the labellum and two lateral lobes magenta, terminal lobe pale-yellow spotted with purple. Flowers sweetly scented.

150. *Eulophia* venosa Reichb.

Bell Creek, and between it and King Leopold Ranges (W.V.F.).

Bulb sessile, large and white ; scapes erect, 1½ 3ft. (including the raceme), leafless but bearing several bract-like scales ; pedicels short, spreading, reflexed after flowering ; sepals brownish-yellow, purple striated ; petals similar in colour but broader and shorter ; lebellum greenish at the base with diverging purple streaks, gibbous, the margins raised and appearing as short lobes, the upper broad portion flat, with crenulated wavy margins and a recurved tip of a pale-purple, the median line of the lower half trifurcated from the base, and forming two lateral purple ridges, the median line in the upper half whitish and papillose. Among long grass in black boggy soil.

DICOTYLEDONEÆ.

URTICALES.

ULMACEÆ.

151. *Trema* aspera Blume.

Mt. Anderson, Grant Range, Fitzroy, Ord, Denham, and King Rivers (W.V.F.).

From a shrub of 2–3ft. to a tree of 20ft., trunk to 8ft. ; diameter 6in. ; bark grey, smooth ; timber pale and rather soft ; leaves from ovate and obtuse and under 2in. long to ovate-lanceolate, acuminate and above 2½in. long ; fruits black. In sandy soil.

152. *Celtis* philippinensis Blanco.

Shrub of 3ft. or a tree of 20ft. ; trunk to 8ft. ; diameter 6in. ; bark grey, smooth ; timber pale, close-grained and fairly hard. In rocky localities.

MORACEÆ.

153. *Ficus* nesophila Miquel.

A spreading tree of 40ft. and giving off adventitious roots ; trunk to 10ft. or more ; diameter above 1ft. ; bark grey, smooth ; timber pale and not hard ; fruits white.

154. *F.* puberula A. Cunn.

Isdell, Sprigg, Charnley, Calder, Ord, Denham, and King Rivers ; Dillen's Springs (W.V.F.).

A tree of irregular straggling growth, giving off adventitious roots, from 25–40ft. high ; trunk 5-6ft.; diameter 1ft. or more ; bark grey or brownish, smooth ; timber pale, rather soft, but tough ; fruits yellow. Grows usually in the crevices of quartzite and sandstone rocks.

155. *F.* hispida L.
Brunswick Bay (A. Cunn.); Sprigg River, Synnott Range (W.V.F.).
A spreading tree of 20ft.; trunk to 5-6ft.; diameter 9in.; bark grey and slightly rough; timber pale and soft; fruits yellowish, hispid. In wet sandy spots, always among quartzite and sandstone rocks.

156. *F.* coronulata F. v. M.
East of Oscar Ranges (Alex. Forrest); Lennard, Fitzroy, Barber, Isdell, Charnley, and Ord Rivers (W.V.F.).
A bushy tree of 40–50ft.; trunk to 25ft.; diameter 1–1½ft.; bark grey, smooth; timber pale and rather close grained. On the banks of streams.

157. *F.* leucotricha Miquel.
Isdell, Charnley, Calder, Denham, and King Rivers; Packhorse, Isdell, Synnott, Artesian, Edkins, and Harding Ranges, Dillen's Springs (W.V.F.).
A tree of 30ft., giving off adventitious roots; bark grey, smooth; timber pale and rather soft; fruits yellowish, hairy. Among sandstone and quartzite rocks.

158. *F.* aspera Forster.
Goose Hill, near Ord River (W.V.F.).
A tree to 40ft.; trunk 10ft.; diameter 1ft. or more; bark greyish or whitish, smooth; timber pale and rather firm; fruits yellowish. In sandy loam.

159. *F.* glomerata Roxb.
Lennard, Fitzroy, Adcock, Barker, Isdell, Charnley, Calder, Ord, and Denham Rivers; Eudialla Springs (W.V.F.).
A tree of 60ft.; trunk 30ft.; diameter 1½–2ft.; bark greyish, smooth or rough; timber pale and not very hard; fruits orange-red, in pedunculate clusters on the trunk and usually infested with green ants. Along the muddy banks of streams and springs.

URTICACEÆ.

160. *Pouzolsia* indica Gaudich.
King Sound District (Froggatt); May, Meda, Lennard, Fitzroy, Barker and Isdell Rivers (W.V.F.).
In sandy and muddy spots.

PROTEALES.

PROTEACEÆ.

161. *Stenocarpus* salignа R. Br.
Near Bell Creek; between Bell Creek and King Leopold Ranges (W.V.F.).

A tree of 30ft. ; trunk to 10ft. ; diameter 9in. ; bark greyish and rather rugose ; timber reddish and not very hard. Also the variety *concolor*.

162. *S.* Cunninghamii R. Br.

From a long bushy shrub to a tree of 30ft. ; trunk 10ft.; diameter 9in. ; bark greyish, smooth or slightly rough ; timber reddish and rather tough ; flowers yellow or greenish-yellow, full of nectar and of a sickly sweet odour. Among sandstone quartzite rocks, frequently in their crevices. In juvenile plants the leaves are bipinnate, occasionally pinnate, with numerous linear mucronate segments.

163. *Grevillea* mimosoides R. Br.

A tall shrub to a tree of 30ft. ; trunk to 12ft. ; diameter under 1ft. ; bark dark-coloured, rough and irregularly fissured ; timber reddish, free-grained and rather hard ; leaves ash-coloured, flowers yellowish-white. In the Flora Australiensis the following occurs in the description of this species :—"Pedicels $\frac{1}{2}$-1 inch." This should read "Pedicels $\frac{1}{2}$-1 line."

164. *G.* miniata (W.V.F.). n. sp.

An erect, graceful looking shrub, the branches and branchlets terete and along with the leaves invested with a short close white-woolly or velvety tomentum, the young shoots ferruginous ; leaves on stout petioles, ovate to almost orbicular, obtuse or nearly truncate, the base cuneate, much undulate and margined by conspicuous prickly teeth, the midrib prominent, much reticulate between ; flowers in dense secund reflexed axillary racemes, solitary or occasionally several together, and then forming short panicles ; peduncles, pedicels and rachises densely silky villous ; perianth orange red. with a pink spotted throat ; pubescent without, slightly bearded at the throat within, the tube broad and oblique, much inflated and revolute under the globular limb ; torus very oblique ; gland conspicuous, horse-shoe shaped ; ovary glabrous, on a very short glabrous stipes on the upper margin ; style hispid, broad and compressed, longer than the perianth, the stigmatic disc orbicular ; fruit ovate-globose, smooth, rounded at the summit, the persistent base of the style lateral ; seeds oblong-ovate, edged with broad membranous margins.

Slopes of Mt. Leake, Lady Forrest Range (W.V.F.). Height 8–12ft. Leaves $2\frac{1}{2}$-$3\frac{1}{2}$ins. long on petioles of $\frac{1}{2}$in. Racemes 2in. or less in length. Peduncles $\frac{1}{2}$-$\frac{3}{4}$in. Pedicels two lines long and slender. Perianths above three lines long. Style $3\frac{1}{2}$ lines long, the stigmatic disc $1\frac{1}{2}$ lines in diameter.

Fruits 5 lines long.
Among quartzite rocks.
Affinity, *G.* angulata, R. Br.

165. *G.* heliosperma, R. Br.
Prince Regent's River (J. Bradshaw and Allen) ; Inglis' Gap, King Leopold Ranges, Mounts House and Clifton ; Adcock, Isdell, Charnley, Calder Rivers, Synnott Range (W.V.F.).
A shrub to a tree of 20ft. ; trunk 5ft. or more; diameter 6in.; bark grey and rather rough ; timber pinkish and fairly tough ; flowers flesh-coloured. In sandy soil.

166. *G.* heteroneura (W.V.F.) n. sp.
Arborescent, the branchlets terete, finely silky-tomentose ; leaves pinnately divided into 3–5 segments, finely tomentose above, closely silky pubescent beneath, the entire cuneate bases very narrow and tapering into long petioles; segments of soft texture, long, linear with obtuse dark-coloured tips, margins slightly refracted, midrib evident on both pages, with three longitudinal nerves visible on each side of the midrib above, and only a single one on each side beneath ; flowers in dense somewhat secund racemes ; several together and forming axillary or terminal simple or compound panicles, the primary and secondary rachises not very stout and almost glabrous ; pedicels slender, glabrous ; perianth white tinged with yellow, glabrous without and nearly or quite so within ; the tube broad, much revolute under the globular limb ; torus very oblique, gland prominent, semi-cupular, slightly crenulated ; ovary glabrous, stipitate ; style slender, much longer than the perianth ; stigmatic disc obliquely lateral, slightly conical in the centre ; fruit broadly oblique, compressed. Summit of Table-top mountain (W.V.F.). Height 30ft. ; trunk 15ft. ; diameter scarcely 9in. ; bark dark grey, rough, and longitudinally fissured ; timber pale-coloured, and moderately hard. Leaves to nearly 1ft. long ; segments 7–10in. long, the entire base and petiole 3in. long. Infloresence :—Racemes 2–4in. long ; panicles 6in. to above 1ft. long. ; pedicels $1\frac{1}{2}$–2 lines ; perianth scarcely four lines long ; ovary stipes nearly $1\frac{1}{2}$ lines long ; style $\frac{3}{4}$in. ; fruit above $\frac{1}{2}$in. long. In sandy soil.
Affinity, *G.* polystachya, R. Br.

167. *G.* erythroclada (W.V.F.) n. sp.
Shrubby to arborescent, branchlets rather thick, reddish, the whole plant glabrous or the young buds ferruginous-tomentose ; leaves pinnate ; segments 9–17, not rigid, often almost filiform ; terete or scarcely flattened, obtuse

or subacute, simple, excepting the lowest two, which are again divided into 2 4 segments, the veins concealed ; flowers small, numerous in erect racemes ; pedunculate and several together in a broad panicle usually exceeding the leaves ; the primary and secondary rachises stout ; perianth white or greenish-yellow, the tube rather slender and slightly contracted beneath the reflexed globular limb, torus oblique, gland semi-annular, conspicuous ; ovary glabrous, stipitate ; style terete, with a rather broad terminal stigmatic cone ; fruit obliquely ovate, somewhat compressed, smooth and viscid ; seed-wing broad and continuous all round.

Upper Isdell and Hann Rivers (W.V.F.).

Height to 30ft.; trunk to 10ft.; diameter 8in.; bark dark-coloured to somewhat reddish, rough, and longitudinally fissured; timber pinkish, and tough leaf ; segments $\frac{1}{2}$ 1ft. long ; racemes 3 6in. long, the panicles frequently above $1\frac{1}{2}$ft. long ; pedicels 1 line ; perianth $1\frac{1}{2}$ line long ; ovary stipes 1 -$1\frac{1}{4}$ line ; style scarcely above two lines long ; fruits $\frac{3}{4}$in. long. In moist sandy loam.

Affinity, *G.* leucadendron A. Cunn.

168. *G.* leucadendron A. Cunn.

Shrub to a tree of 30ft. ; trunk 10ft. ; diameter 10in.; bark dark-coloured, rough and longitudinally fissured ; timber whitish to reddish, and rather tough ; flowers white, in terminal panicles of a foot or more in length ; fruits covered with an almost liquid viscid substance.

169. *G.* pyramidalis A. Cunn.

Prince Regent's River (A. Cunn.) ; Lennard, Barker and Isdell Rivers, etc. (W.V.F.).

In sandy loam.

As surmised by Bentham in the Flora Australiensis, this proves to be only a short-leaved form of *G.* leucadendron A. Cunn. In the field they cannot be separated.

170. *G.* chrysodendron R. Br.

A beautiful symmetrical tree to 50ft. in height ; trunk to 20ft.; diameter 2ft. ; bark greyish, rough, and longitudinally fissured ; timber reddish, straight grained and not very hard, prettily grained ; flowers showy ; perianth brownish-yellow or greenish ; style orange-red with a yellow stigma. The flowers secrete abundance of nectar, which falls on the ground at night ; it affords food for numerous birds and insects.

171. *G.* dimidiata F. v. M.

Careening Bay (A. Cunn.) ; Ord River (W.V.F.).

A tree of 20ft.; trunk to 10ft.; diameter 9in.; bark greyish-brown, and moderately tough ; timber reddish, straight-grained, and not very hard ; flowers yellow : fruits similar in shape, size, and viscidity to those of *G.* mimosoides R. Br., from which this species can only be readily separated when in flower. Allan Cunningham's specimens are in leaf only and are therefore doubtful.

172. *Hakea* Cunninghamii R. Br.

A tree 15-20ft. ; trunk 10ft. ; diameter 1ft.; bark dark-grey, rough, somewhat corky and longitudinally fissured, timber brownish and fairly close-grained ; flowers yellow.

173. *H.* lorea R. Br.

A tree of 20ft. ; trunk 8ft. ; diameter 9-12in. ; bark dark-grey, $\frac{1}{2}$-$\frac{3}{4}$in. thick, rough, corky, deeply longitudinally fissured ; timber brownish, and not very hard, flowers yellow. The "Cork-tree" of the West Australian Goldfields, where it is regarded as an indication of the existence of fresh water at shallow depths.

174. *H.* suberea S. Moore is the western form of H. lorea, R. Br.

175. *H.* macrocarpa A. Cunn.

A tree of 20ft.; trunk 9ft. ; diameter 9in. ; bark dark-grey, very rugged, often corky, longitudinally fissured ; timber brownish and fairly hard ; flowers usually on the old wood, white to greenish-white.

176. *H.* arborescens R. Br.

A tree 20-30ft., trunk to 12ft., diameter 1ft., bark dark-grey or blackish, rough, thick, deeply longitudinally fissured ; timber brown and rather hard and tough ; flowers white or pink.

177. *H.* Morrisoniana (W.V.F.) n. sp.

Arborescent ; young leaves sericeous ; leaves entire, long-linear, obtuse, much compressed but rather thick and rigid, of a greyish hue, veinless, with scarcely evident broad mid-ribs and somewhat thickened margins : flowers numerous in shortly pedunculate racemes, either lateral on the old wood or axillary on the younger growth, solitary or several together, and often forming short panicles which are occasionally terminal through leaf-suppression ; pedicels, rachises and periantbs densely silky pubescent, the tomentum closely oppressed and short ; perianth-tube slightly dilated at the base, revolute beneath the limb, torus oblique ; gland prominent, horseshoe-shaped ; ovary

glabrous, stipitate ; style glabrous, slightly compressed, the stigmatic disk oblique, with a prominent conical centre : fruit smooth, obliquely ovate, terminating in a stout recurved beak. Banks of Hann River, between Mt. Caroline and the junction with Macnamara Creek (W.V.F.).

Height 30 40ft., trunk to 20ft., diameter 1ft. or more ; bark dark-coloured, very thick, deeply olngitudinally fissured and corky. Timber dark brown, not very hard, straight-grained. Leaves half to above 1ft. long, $1\frac{1}{2}$ lines broad. Racemes $\frac{1}{2}$ to $\frac{3}{4}$ft. long. Pedicels slender, 2 -$2\frac{1}{2}$ lines. Perianth $\frac{1}{3}$in. long, white. Ovary-stipes $1\frac{1}{2}$ line. Style above $\frac{3}{4}$in. Fruit above 1in. long by a little more than $\frac{3}{4}$in. broad ; beak at least $\frac{1}{4}$in. long.

In moist sandy soil.

Named in honour of the late Dr. A. Morrison, formerly Government Botanist of Western Australia.

Affinity, *H.* lorea, R. Br.

SANTALALES.

SANTALACEÆ.

178. *Authobolus* foveolatus F. v. M.

Perianth lobes in both male and female flowers, three only : fruits smooth and greenish when ripe.

179. *Exocarpus* latifolia R. Br.

A shrub to a tree of 25ft. ; trunk 8 -10ft., diameter 9in., bark dark grey to almost black, rough, timber reddish, close-grained, with a faint sandalwood odour, flowers greenish-yellow, fruits red.

OLACACEÆ.

180. *Opilia* amentacea Roxb.

York Sound (A. Cunn) ; Isdell, Charnley, Calder and Barker Rivers ; Edkins Range, Dillen's Springs (W.V.F.). An erect shrub of 8ft., branches pendulous, and somewhat flexuose ; flowers greenish-white, scented.

LORANTHACEÆ.

181. *Viscum* articulatum Burm.

Messmate Creek, Packhorse Range (W.V.F.).

Plant greenish-yellow, flowers greenish, fruits yellow.

Parasitic on *Buchanania oblongifolia* (W.V.F.). According to Hooker fil., the specimens referred by Bentham to this species, in the Flora Australiensis belong to V. japonicum Thunberg.

182. *Loranthus* ferruginiflorus (W.V.F.) n. sp.

Branches long and pendulous ; the branchlets terete, glabrous or closely ferruginous-tomentose ; leaves glabrous, opposite, lanceolate, obtuse, tapering into the petioles, rather firm and obscurely 3 5 nerved ; flowers on axillary pedunicles, each peduncle once-forked, each branch bearing two sessile or almost sessile flowers, the inflorescence and perianths closely ferruginous-tomentose ; bracts orbicular, almost entirely enveloping the calyces ; calyx-limb truncate or slightly repand ; buds clavate at the tips and dilated at the base to a greater diameter than the calyx ; corolla divided to the base, or almost so, into 5-segments ; anthers oblong-linear, adnate ; style angular, slender, the stigma not large ; fruit globose, 3 4 lines diameter, rusty-red.

Mt. Rason, Broome, Sunday Island, Grant Range (W.V.F.)

Leaves 4–8in. long, the petioles 1in. or less. Peduncles $\frac{1}{2}$in., the branches somewhat shorter. Corolla red, the segments about 1in. long, Fruit 3–4 lines diameter.

Parasitic on *Eucalyptus* sp. and *E.* clavigera (A. Cunn.)

Affinity, L. pendulus Sieber and *L.* bifurcatus Benth.

183. *L.* signatus F. v. M.

Lennard, Isdell, Charnley, and Calder Rivers ; Dillen's Springs, Sunday Island (W.V.F.).

Flowers greenish-red.

184. *L.* biangulatus (W.V.F.) n. sp.

Pendulous, quite glabrous and somewhat glaucous, the internodes acutely two-angled or narrowly winged, widened upwards. Leaves opposite or subopposite, narrow to broad-lanceolate, obtuse, tapering to the bases, mostly vertical, the veins numerous, very oblique and reticulate between ; inflorescence an axillary rarely terminal distinctly pedunculate raceme of usually five branches, each branch with three terminal closely sessile flowers ; buds slender, bract as large as the adnate portion of the calyx ; limb of the calyx rather broad, membranous, obscurely toothed, and half as long as the tubes ; corolla segments usually six, very narrow ; anthers linear, adnate, much longer than the perianth segments ; style slender, the stigma not broad ; fruit ovoid, brownish.

Base of Mt. Broome ; Sprigg, Isdell, and Calder Rivers (W.V.F.).

Leaves 4in. long or less. Corolla-segments $\frac{3}{4}$in. long, pale yellow to red in the lower half, green in the upper portion. Anthers green or greenish-yellow. Fruit above four lines long.

Parasitic on *Tristania* suaveolens Smith, and *Eugenia* eucalyptoides F. v. M.
Affinity, *L.* signatus, F. v. M.

185. *L.* longifflorus Desr.
Goose Hill near Ord River (W.V.F.).
Flowers yellow, stamens pink.

186. *L.* acacioides (A. Cunn.).
Leaves often whitish, flowers orange, or orange-red, fruits scarlet. Parasitic on *Acacia* flavescens, (A. Cunn.) and *Cochlospermum* heteronenum, F. v. M.

POLYGONALES.

POLYGONACEÆ.

187. *Polygonum* minus Hudson.
A form along the Isdell and Barnett Rivers has the stems and branches prostate to 2–3ft., the shoots ascending.

188. *P.* attenuatum R. Br.
Hann River (W.V.F.).
Stems erect, 1–2ft. ; flowers white. In muddy spots.

189. *P.* lapathifolium L.
Fortescue River (H. S. Carey) ; Lennard, Isdell, Barnett, and Fitzroy Rivers, Wingrah Pass, Napier Range (W.V.F.).
Stems creeping in mud and water for many feet ; branches erect or ascending to 2ft. ; perianths white.

CENTROSPERMÆ.

CHENOPODIACEÆ.

190. *Chenopodium* auricomum Lindley.
Fitzroy River (W.V.F.).
Erect, 3–6ft. high. "Blue Bush." In black boggy soil.

191. *Atriplex* Muelleri Benth.
Fortescue River (Alex. Forrest) ; Port Hedland (W.V.F.).
In saline sandy soil.

192. *A.* elachophyllum F. v. M.
Broome (W.V.F.).
In saline flats.

193. *Chenolea* Muelleri Benth.
Broome (W.V.F.).
In damp saline soil.

194. *Salicornea* cinerea F. v. M.
Wyndham (W.V.F.).
In muddy spots along the shores of Cambridge Gulf.

AMARANTACEÆ.

195. *Plilotus* longistachyus W.V.F. on. sp.

An erect annual, much branched from the base ; branches greenish striate and, as well as the foliage, scantily woolly-tomentose ; leaves lanceolate, obtuse, tapering into rather short petioles, very much crisped ; flowers small, closely packed in long cylindrical spikes, which are shortly pedunculate, and form a large corymbose somewhat leafy panicle ; bracts scarcely a quarter the length of the perianths ; ovate, acute, scarious, with rather prominent darker slightly woolly midribs ; bracteoles broadly ovate, mucronate, shining scarious, shorter than the bracts and along with them persistent on the woolly rhachis ; perianth-tube very short and densely invested with short articulate straight hairs ; segments trinerved, invested without with long articulate straight hairs, glabrous within, the outer with obtuse bifid or trifid apices, the inner narrower and acute, all narrow-lanceolate ; staminal cup short, free, not surrounded by hairs, the truncate summit ciliate with slightly woolly articulate hairs ; filaments very slender, unequal, all antheriferous ; ovary shortly stipitate, with a slender central style, the summit of the ovary and lower half of the style invested with long straight hairs, otherwise glabrous.

Upper Isdell River ; Mt. Anderson. (W.V.F.).

Height 3-5ft. Leaves 1-2in. long. Spikes 3–9 in. long, about $\frac{3}{4}$in. diameter. Perianth $\frac{1}{3}$in. long, the segments greenish with conspicuous glabrous pink tips.

Among sandstone and quartzite rocks.

Affinity, *P.* alopecuriodes, F. v. M.

196. *P.* astrolasius F. v. M.

N.W. coast (A. Hughan) ; South of Fitzroy River (Mayo Logue).

Among sand hills.

197. *P.* Johnstonianus (W.V.F.). n. sp.

Stems numerous, prominent or ascending, forming a thick perennial stock, quite glabrous ; leaves linear to linear lanceolate, acute, gradually tapering into moderately long petioles ; spikes pedunculate, somewhat obovoid, numerous and umbellate at the ends of short branchlets ; the whole inflorescence forming a dense panicle, bracts and bracteoles ovate-lanceolate, acute or shortly aristate, half as long as the perianth ; perianth surrounded at the base by a ring of short straight hairs ; segments free almost from the base, the outer ones ovate-lanceolate, obtuse, glabrous, the three inner ones narrower, nerved

and invested half way up with intricate wool ; staminal cup very short, the filiform filaments hardly dilated at the base and not very unequal ; ovary glabrous ; seeds shining.

Six miles N.E. of Mt. Eliza, Lennard River (W.V.F.).

Stems 1-2ft. long. Leaves mostly 1½-2in. long. Peduncles 1–2 lines ; spikes about three lines in diameter ; panicles 2–3 in. in diameter. Perianths 2½ lines long, the segments crimson edged with white, the wool and ovary crimson. Seeds dark brown.

Named in memory of the late Mr. Harry F. Johnston, Surveyor-General of Western Australia.

In sandy loam.

Affinity, *P.* spicatus, F. v. M.

198. *P.* lanatus (A. Cunn).

Cygnet Bay (W.V.F.) Segments trinerved, pale pink.

In sandy soil.

199. *P.* Macleayli F. v. M.

Diffuse, much-branched, 2ft. high ; perianths white.

200. *P.* brachyanthus F. v. M

Derby ; Goody Goody (W.V.F.).

Apparently an annual with scantily hairy stems and linear leaves.

In sandy spots.

201. *P.* humilis F. v. M.

A Port Hedland form is somewhat woolly with prostrate or ascending stems of 1ft. ; inflorescence through leaf suppression becoming paniculate ; perianths white, scarcely two lines long.

202. *Alternanthera* nana R. Br.

Fortescue River (J. Forrest) ; Meda, May, Lennard, Barker, Fitzroy and Isdell Rivers (W.V.F.).

Erect and much-branched from the base and, along with the leaves, often reddish-coloured and almost glabrous ; leaves ovate-lanceolate ; perianths frequently slightly woolly.

In sandy loams.

203. *A.* augustifolia R. Br.

May, Meda, Lennard, Fitzroy and Isdell Rivers (W.V.F.).

In sandy soil.

204. *A.* nodiflora R. Br.

Prostrate or procumbent to 1ft. ; perianths white.

205. *A.* decipiens Benth.
King Sound District (Froggatt) ; Meda, Lennard, and Fitzroy Rivers. (W.V.F.).
In sandy spots.

206. *Achyranthes* aspera L.
Erect, 2–4ft. high. A pest.

207. *Gomphrena* canescens R. Br.
A most variable species ; 1–2ft. in height ; flowers pink or white. A good fodder plant.

208. *G.* parviflora Benth.
Prince Regent's River (A. Cunn.) ; Upper Isdell River, Cygnet Bay (W.V.F.).
The Isdell River plant has a thick fleshy fusiform tap-root, which is apparently perennial ; stems prostrate and much branched, 1–3ft. long. The Cygnet Bay examples are bushy, erect, canescent, 1ft. in height ; leaves lanceolate ; spikes mostly axillary.

209. *G.* brachystylis F. v. M.
Near Derby ; Meda, May, Lennard and Isdell Rivers (W.V.F.).
In sandy soil.

PHYTOLACCACEÆ.

210. *Gyrostemon* ramulosus Desfont.
Diffuse or ascending and often under 1ft. in height to a tall shrub or tree of 25ft. in height ; trunk 6ft., diameter 6in., bark grey, rough and corky ; timber pale, soft and light.

AIZOACEÆ (FICOIDEÆ.)

211. *Sesuvium* portulacastrum L.
Sunday Island (W.V.F.).
Stems procumbent to 2ft. long ; flowers pinkish within.
In saline spots.

212. *Trianthema* turgidifolia F. v. M.
Stems prostrate to ascending, 2–6in. long ; leaves succulent, thickly clavate ; ovary purple at the base.

213. *T.* oxycalyptra F. v. M.
King Sound District (Froggatt) ; Broome, Derby, Goody Goody ; May, Lennard, Fitzroy and Isdell Rivers (W.V.F.).
Stems prostrate or ascending, 6in. to 2ft. long ; flowers white or pink.

214. *Mollugo* spergula L.
W. Australia (Drum.) ; Meda, Fitzroy, Isdell and Lennard Rivers (W.V.F.).
In sandy soil.

PORTULACACEÆ.

215. *Portulaca* tuberosa Roxb.

A fibrous-rooted annual or a tap-rooted biennial or perennial; stems loosely branched, ½–1½ft. high; leaves 1–1½in. long; petals ½in. long, bright yellow, styles 5-cleft.

When growing in saline spots a tap-root is developed, and the plant ceases to be annual; as inland districts are approached this form gradually disappears and is replaced by a fibrous-rooted annual which constitutes the *P.* filifolia, F. v. M. The distinctions mentioned in the "Flora Australiensis" are not constant.

216. *P.* digyna F. v. M.

Prince Regent's River (J. Bradshaw and Allen), Lennard and Isdell Rivers. (W.V.F.).

Stems prostrate, covering 6–12ins., and along with the branches and leaves red coloured; leaves orbicular, thick and succulent; flowers pink; stamens often reduced to five.

217. *P.* bicolor F. v. M.

Prostrate, forming patches 3–6in. across; flowers yellow.

218. *P.* australis Endl.

Prince Regent's River (J. Bradshaw and Allen): Broome, Isdell River (W.V.F.). Flowers yellow.

219. *Calandrinia* strophiolata, F. v. M.

Radical leaves terete, succulent, to 3in. long, those on the scapes above 1in., pedicels ¾ to above 1in. long; flowers ½–¾in. across, reddish-purple; petals 10–12, narrow-spathulate, mucronate; stamens numerous, irregular; anthers pale yellow or purplish; styles five.

In sandy soil.

220. *C.* quadrivalvis F. v. M.

Yule and Sherlock Rivers (J. Forrest); Isdell River, near Grace's Knob (W.V.F.).

Usually of straggling habit but sometimes erect or ascending, flowers red.

221. *C.* Tepperiana (W.V.F.) n. sp.

A glabrous annual with a succulent, cylindrical tap-root, the stock surmounted by a dense tuft of terete fleshy leaves; scapes erect and ascending, 1–6 or more arising from the leaves, leafless excepting 1-2 very small scarious scales; flowers few, each on a slender pedicel and forming short racemes, rarely panicles, on the upper portion of the scape; bracts ovate-lanceolate, acute, scarious, sepals broadly ovate, mucronate-acute, very thin; petals 6–8, lanceolate; filaments numerous, short; anthers oblong;

style divided to the base into four linear stigmatic lobes ; capsule ovoid, longer than the calyx, four-valved ; seeds numerous, smooth. May and Lennard Rivers (W.V.F.).

Leaves 1½ to above 2in. long. Scapes ¼–1ft. high. Pedicels 1¼in. or less. Bracts 1 line long. Sepals two lines long. Petals 3¼-4 lines long, red. Anthers yellow. Seeds black and shining.

In grassy sandy spots.

The species is named in honour of Mr. J. G. O. Tepper, of South Australia.

Affinity, *C.* uniflora, F. v. M.

CARYOPHYLLACEÆ.

222. *Polycarpaea* longiflora F. v. M.

Erect 1–1½ft. ; flowers crimson and very showy.

223. *P.* Holtzei Maiden and Betche in Ewart and Davies' "Flora of the Northern Territory," 1917, p. 109.

This species was recognised by Mr. Fitzgerald as new, and he gave it a name, but the MS. of Maiden and Betche's species was in Prof. Ewart's hands long before Mr. Maiden saw Mr. Fitzgerald's description. The North-Western Australia localities given (*loc. cit.*) are, between the Gascoyne and Fortescue Rivers, (H. S. King), King Sound (W. W. Froggatt) ; Mr. Fitzgerald's localities are base of Mt. Eliza, near Lennard River, Isdell and King Rivers ; Mts. Barnett and Harris, Sunday Island (W.V.F.).

224. *P.* involucrata F. v. M.

Lennard and Isdell Rivers (W.V.F.).

On sandy and stony rises.

RANALES.

NYMPHECACEÆ.

225. *Nymphaea* gigantea Hook.

Rootstock bulbous, the roots thick, white, eaten by aborigines ; flowers blue, the petals frequently less than 1in. long.

Found in Northern Australia generally.

MENISPERMACEÆ.

226. *Tinospora* smilacina Benth.

Twines over the tops of shrubs and small trees. Flowers greenish-yellow ; fruits scarlet.

Includes *T.* Walcotti, F. v. M. Known along the Fitzroy and Lennard Rivers as "Native Ivy."

LAURACEÆ.

227. *Cassytha* strigosa W.V.F., n. sp.

Quite glabrous excepting the inflorescence; stems filiform; flowers distant, in simple slender spikes, the rhachis invested with rigid shining brown strigose hairs; bracts ovate, as long as the outer perianth-segments; scantily strigose; outer segments of the perianth not half as long as the inner, scantily ciliate, the inner very broad and glabrous; three outer stamens opposite the outer perianth-segments broad and petal-like; ovary glabrous; fruit scantily strigose, many ribbed, ovoid, reddish-brown, the persistent perianth-lobes of a bright pink color.

Eastern base of Mt. Broome (W.V.F.).

Spikes 1–1½in. long. Perianths under ¾ line long, white. Fruits 2-2½ lines long.

Parasitic in shaded spots on low shrubs.

Affinity, *C.* filiformis L.

228. *C.* filiformis L.

Broome, near Derby; Meda, May, Lennard, Fitzroy, Isdell, Barker, Charnley, and Calder Rivers; Walcott Inlet (W.V.F.).

A hirsute form. Flowers and fruits white.

RHOEADALES.

CAPPARIDACEÆ.

229. *Cleome* oxalidea F. v. M.

Sturt's Creek (W.V.F.); May and Lennard Rivers (W.V.F.).

Scapes many from the one rhizome, filiform; sepals 1½ lines long, red; capsule to above 1½in. long. In ironstone gravel.

230. *Gynandropsis* Muelleri Benth.

About 2ft. high, of straggling habit; flowers yellow.

231. *Capparis* lasiantha R. Br.

Branches climbing many yards; flowers white.

232. *C.* nummularia DC.

Petals white; filaments pale to purple.

233. *C.* umbellata R. Br.

Careening Bay (A. Cunn.); near Wyndham, Ord and Denham Rivers, Swan Point (W.V.F.).

A tall shrub or small tree supported by others; 10-15ft. high; trunk 4–5ft.; diameter 3–4in.; bark grey, smooth; timber pale, rather soft but close-grained; branches straggling, sometimes shortly climbing; flowers white. Among sandstone and quartzite.

234. *C.* lucida R. Br.
N.W. coast (A. Cunn.) ; H. 72, near Lennard River, Packhorse, Isdell, Synnott, Artesian, and Edkins Ranges (W.V.F.). A tree of 20–30ft. ; trunk 10ft. ; diameter 1ft. ; bark grey, thin, but rough and longitudinally fissured ; timber pale, moderately hard and close-grained. On sandstone and quartzite elevations and in gorges.

235. *C.* umbonata Lindley.
Arborescent, 20–30ft. high ; trunk to 12ft. ; diameter 6–9in. ; bark grey, rough and irregularly fissured ; timber pale and rather soft ; branches pendulous, often glabrous, pedicels to above 2in. long ; petals and filaments white or pink ; fruits globular, occasionally above 2in. diameter, scented. On gravelly or grassy plains. The fruits are eaten by aborigines and are known throughout Kimberley as "Native Oranges."

CRUCIFERÆ.

236. *Cardamine* eustylis F. v. M.
Fitzroy and Lennard Rivers (W.V.F.).
Valves of the pod 1-nerved. On grassy flats.

SARRACENIALES.

DROSERACEÆ.

237. *Drosera* indica L.
Flowers white, pink or red with a darker centre. A North-Western form has the stems and leaves scarlet ; flowers dark-red or deep scarlet ; styles usually 4, bifid almost to the base.

238. *D.* Burmanni Vahl.
Prince Regent's River (A. Cunn.) ; Isdell, Sprigg, and Charnley Rivers ; Packhorse and Isdell Ranges (W.V.F.). Leaves rosulate, scarlet ; scapes to 1ft. high ; sepals papillose ; flowers purplish. Wet spots.

239. *D.* Banksii R. Br.
Dingle Creek, base of Packhorse Range (W.V.F.)
Flowers white. In wet soil.

240. *D.* petiolaris R. Br.
Flowers white or reddish. This species is also in Papua.

241. *Aldrovanda* vesciculosa L.
Upper Isdell River (W.V.F.).
Floating in tangled masses in water.

242. *Byblis* liniflora Salisb.
Flowers purple, petals toothed. The species occasionally has a subtropical distribution.

ROSALES.

PITTOSPOREÆ.

243. *Pittosporum* phillyroides DC.
A shrub of 10–12ft. or a tree of 30ft. ; trunk 10ft.; diameter 6–12in.; bark greyish, smooth ; timber whitish, branches usually pendulous, flowers yellow. "Native Willow."

244. *Citriobatus* pauciflorus (A. Cunn.)
Careening Bay (A. Cunn.), near Synnott Range, and on a tributary of the Sprigg River, 10 miles N. of Mt. Bartlett (W.V.F.).
A Coprosma-like shrub of 10ft. or a tree of 25ft. ; trunk 10ft.; diameter 6in.; bark greyish, thin and rather smooth; timber pale, dense and moderately hard, fruits greenish-yellow or yellow. On the banks of and in the beds of watercourses.

LEGUMINOSÆ.

MIMOSOIDEÆ.

Acacia (*see* introductory note).

245. *A.* kimberleyensis W.V.F. in Maiden, *Proc. Roy. Soc., N.S.W.* LI., 112 (1917).

246. *A.* curvicarpa W.V.F.. *Loc. cit.*, p. 114.

247. *A.* pachyphloia W.V.F. *Loc. cit.* p. 116.
(For a complete list of North-West Australian Acacias *see* Maiden, *Proc. Roy. Soc., N.S.W.* LI, 71, 1917.)

248. *Eyrthrophloeum* Laboucheri F. v. M.
A tree 30–40ft., the branches spreading ; trunk 10–15ft. ; diameter 1–1½ft. ; bark dark-grey, rough ; timber a very dark brown, almost black, close-grained, moderately heavy, and one of, if not the hardest wood in Australia ; flowers greenish-yellow. The "Black Bean" of N.W. Australia.

249. *Dicrostachys* Muelleri Benth.
George's River and Jones' Creek (J. Forrest) ; May and Lennard Rivers, near Inglis' Gap, King Leopold Ranges (W.V.F.).
An erect thorny shrub, 12–16ft. ; fertile, flowers yellow ; staminodia of the neuter ones purple ; pod glabrous, much curved, tardily dehiscent, 1–2in. long, 4–5 lines broad ; valves hard, convex ; seeds subrotund, a shining brown.

250. *Neptunia* gracilis Benth.
Sturt's Creek (F. v. M.) ; Fitzroy, May, Lennard, Barker, Isdell, Adcock, Hann, Barnett, Charnley, King and Ord Rivers (W.V.F.)
Stems form a few inches long and prostrate or procumbent to erect and 4-6ft. high.

251. *N.* monosperma F. v. M.
Stems almost prostrate and several feet long to erect and 2–3ft. high.
In the majority of North-West Australian examples, the leaflets are fewer than those of the type.

252. *Albizzia* procera Benth.
From the Adcock to the Isdell Rivers (W.V.F.).
An evergreen tree of 40ft. ; trunk to 15ft. ; diameter 6–9in. ; bark grey, moderately rough ; timber brown, hard and tough. In stony soil.

253. *A.* lebbek Benth.
Sprigg and Barker Rivers and tributaries (W.V.F.).
A deciduous tree of 25–30ft. ; trunk to 8ft. ; bark dark-grey, rough and longitudinally fissured. ; timber very dark-brown, glistening, soft and light ; leaves of a vivid green ; corolla greenish-yellow ; stamens $\frac{3}{4}$–1in. long, yellow in the lower half and including the anthers, green in the upper half ; pod often 10in. long and 2in. broad ; seeds brown, orbicular, compressed about $3\frac{1}{2}$ lines, broad.

254. *A.* monilifera F. v. M.
Goose Hill, Ord River (W.V.F.).
A tree of 30–40ft. ; trunk to 12ft. ; diameter 1ft. ; bark greyish, rather rough ; timber dark-brown and rather hard ; stipular spines sometimes entirely suppressed, others above 1in. long ; flowers white. In sandy loam.

CÆSALPINIOIDEÆ.

255. *Bauhinia* Cunninghamii, Benth.
A tree of between 30–40ft., the branches spreading ; trunk 10ft.; diameter 1–2ft.; bark dark grey, rough ; timber purplish, soft, but very tough, flowers scarlet. "Bauhinia."

256. *Cassia* notabilis F. v. M.
A spreading shrub of 3ft. in height ; pod compressed, thin, 1–$1\frac{1}{2}$in. long, above $\frac{1}{2}$in. broad ; seeds dark-greyish, obovate retuse, thick and reticulate.

257. *C.* venusta F. v. M.
Erect, 2–4ft. ; seeds black, obovate, thick, reticulate.

258. *C.* neurophylla (W.V.F.).

A diffuse shrub, green and glabrous, the branchlets angular; leaves shortly stalked; stipules small, subulate; leaflets in 2-3 rather distant pairs ovate to ovate-lanceolate, mucronate, flat, thinly coriaceous, the venation prominent; glands large, acutely conical, between each pair of leaflets; peduncles axillary, shorter than or scarcely exceeding the leaves, bearing an umbel of three flowers on pedicels longer than the calyces; bracts setaceous; sepals broadly ovate; petals roundish; stamens 10, occasionally eight; anthers all on short filaments of which the lower are slightly the longest; ovary glabrous; pod oblong falcate, very flat; valves thinly coriaceous; seeds parallel to the valves.

Edkins Range, hills near Barker River (W.V.F.).

Height 1-3ft; leaflets $\frac{3}{4}$-$1\frac{1}{2}$in. long, bright yellow; anthers dark yellow. Pod $1\frac{1}{2}$–$1\frac{3}{4}$in. long by $\frac{1}{3}$in. broad.

In crevices of quartzite rocks.

Affinity to *C.* Chatelainiana Gaudich.

259. *C.* sophera L.

Lennard River (W.V.F.).

Diffuse, 3–4ft. high or more. In stony river bed.

260. *C.* retusa Sol.

Denham and King Rivers (W.V.F.).

A shrub 3–4ft. high; leaflets 2-3 pairs, often mucronate; peduncles slender, frequently longer than the leaves, 3–5 flowered; pedicels slender. Among quartzite gravel.

261. *C.* australis Sims.

Near Native Well, between Derby and Meda Station (W.V.F.).

Erect, from 2–3 to 10ft. high, often diffuse, leaflets fewer than in the type, 1–$1\frac{1}{2}$in. long. In sandy soil.

262. *C.* mimosoides L.

Stems ascending to 1ft.; flowers yellow.

263. *C.* glutinosa DC.

Erect, 3–4ft. high, viscid.

264. *C.* cladophylla W.V.F. n. sp.

A small diffuse shrub, the branches and leaves closely invested with short spreading white or yellowish hairs; leaf-rachis about half an inch long, terminating in an acute point or sharp thorn, the whole leaf resembling a short leafy branch; leaflets in two pairs, obliquely-obovate, terminating in a bent mucro, not very thick and rather soft, the upper pair much the largest, the gland between

each pair small and conspicuously stipitate ; stipules semi-cordate-reniform, leafy ; peduncles axillary, solitary, filiform and with the short filiform pedicels longer than the leaves and bearing an umbel of a few flowers ; sepals small, broadly ovate ; petals roundish ; pod shortly stipitate, linear-oblong ; slightly falcate, terminating in a short straight point, very thin and flat, pubescent ; seeds mostly five.

Hills near the junction of Hann and Barnett Rivers ; Edkins Range ; Dillen's Springs (W.V.F.).

Height 1–2ft ; leaflets $\frac{1}{2}$–$\frac{3}{4}$in. long ; stipules 2 -3 lines diameter ; petals yellow ; pod 1–1$\frac{1}{2}$in. long by $\frac{1}{4}$in. across ; seeds dark-brown. Among sandstone and quartzite rocks.

PAPILIONATÆ.

265. *Mirbelia* oxyclada F. v. M.

A spreading spinescent shrub, 2–3ft. high ; flowers yellow, 2–3 together, shortly pedicellate on lateral or axillary peduncles ; calyx 2 -2$\frac{1}{2}$ lines long, sericeous ; lobes almost setaceous, much longer than the tube ; standard slightly exceeding the calyx ; wings and keel shorter ; ovary and fruit glabrous. In sandstone and quartzite country.

266. *Jacksonia* petrophiliodes W.V.F. n. sp.

A much-branched rigid shrub, glabrous excepting the inflorescence ; barren branches rather long and slender, angular and sulcate, not spinescent ; scales linear ; flowers mostly on the lower portion of the plant, pedicellate, few to many together, forming lateral or axillary white pubescent clusters on head-like racemes ; bracts and bracteoles persistent, ovate, acuminate, shorter than the flowers ; calyx hirsute, the tube broad, the lobes persistent, erect, linear-lanceolate, acute, much longer than the tube, the upper ones shorter than the others and connate to near their summits ; petals shorter than the calyx ; standard shortly acuminate, wings longer than it ; keel acuminate, as broad as or broader than the wings and about as long ; ovary shortly stipitate, 2-ovulate ; pod ovate, turgid, densely silky-villous, about as long as the calyx and terminating in an acuminate exserted point ; seeds two.

South of the Fitzroy River (Mayo Logue).

Height 1–2ft. Scales 1–2$\frac{1}{2}$ lines long. Pedicels 1 line or less. Calyx 4 lines long, the tube less than 1 line long. Petals yellow. Sandy, scrubby country, "Pindan."

Affinity to *J.* odontoclada F. v. M.

267. *J.* aculeata W.V.F. n. sp.

An erect rigid much-branched shrub, glabrous or more or less sericeous, branchlets short, rigid, striate, divaricate; leaves reduced to numerous small subulate pungent, spreading or recurved scales; flowers axillary, solitary, very shortly pedicellate; bracts small, caducous; bracteoles two, adherent to the base of the calyx-tube, small subulate, pungent-pointed; calyx sericeous, the lobes broad-linear to narrow lanceolar, terminating in slender acute points, the upper ones connate to below the middle, about as long as the tube, reflexed, persistent; corolla long, persistent; standard comparatively broad and slightly exceeding the calyx-lobes, wings slightly shorter; keel almost straight, obtuse, broader and shorter than the wings; ovary closely sessile, densely white tomentose, 2-ovulate; style short, slightly curved, glabrous; pod obliquely obovate, turgid, the rigid base of the style persistent, white tomentose and reticulate, scarcely as long as the calyx, and perfecting one seed.

South of the Fitzroy River (Mayo Logue).

Height 3ft. or more. Calyx scarcely 2 lines long, the lobes nearly 1 line long. Carolla reddish-yellow. Throughout "Pindan" and desert country.

Affinity to the series Pungentes.

268. *J.* thesioides A. Cunn.

Isdell, Charnley, Calder, and Hann Rivers, Packhorse Range (W.V.F.).

A graceful shrub 6–20ft. high; branches often pendulous; calyx frequently 3 lines long, sericeous; flowers yellow. In sandstone and quartzite country. The foliage is eaten by stock.

269. *J.* pteroclada F. v. M.

Stems numerous from the one stock, ascending, 6–9in.; flowers yellow.

270. *Gastrolobium* grandiflorum F. v. M.

An erect much-branched shrub, 4–8ft.; leaves opposite or 4-whorled; flowers scarlet; pod $\frac{1}{2}$in. long, almost glabrous, reticulate. The "Wall-flower Poison."

271. *Bossiaea* phylloclada F. v. M.

Forrest, Carson, Roe, and Drysdale Rivers (J. Bradshaw and Allen); King and Isdell Rivers, near Grace's Knob (W.V.F.).

Erect, rigid, 3–5ft.; branches often pendulous; upper stamen free or almost so.

272. *Templetonia* Hookeri Benth.
N.W. Coast (Bynoe) ; Isdell, Charnley, Calder, Denham, and King Rivers ; Packhorse, Synnott, Artesian, Edkins and Harding Ranges, Sunday Island, Dillen's Springs (W.V.F.).
An erect graceful shrub, 6–10ft. ; flowers yellow. Usually among sandstone and quartzite rocks.

273. *Crotalaria* punicea L.
May, Lennard, Fitzroy, Isdell, Charnley, Barnett, and Hann Rivers (W.V.F.).
In sandy loam.

274. *C.* alata Hamil.
Paradise Creek (J. Bradshaw and Allen) ; Isdell River, near Grace's Knob, Synnott Creek (W.V.F.).
Of straggling habit ; stems to 2ft. long ; flowers bright yellow. In damp grassy spots.

275. *C.* medicaginea Lam.
Stems erect, 2–3ft. ; flowers yellow.

276. *C.* verrucosa L.
Erect, 2 4ft. ; flowers purple.

277. *C.* linifolia L.
Often an erect slightly branched annual of 2–4ft. in height.

278. *C.* crassipes Hook.
Stems erect 4–6ft. ; leaflets 3 5in. long, rarely 2in. ; flowers bright yellow ; pods much inflated.

279. *C.* membranacea W.V.F. n. sp.
An erect much-branched annual, the stems and branches terete, and, along with the foliage and inflorescence, closely invested with long spreading pale or yellowish hairs ; leaves membranous, simple, almost or quite sessile, ovate to lanceolate, rounded at the apex ; stipules lanceolate, narrowed upwards ; flowers in loose terminal or axillary racemes of usually 2–4 flowers only ; peduncles and pedicels rather short ; bracts linear, shorter than the calyx ; calyx densely invested with long spreading hairs, lobed nearly to the base, the two upper lobes much broader than the others, the lateral ones and the lower one shortly united, all scarcely acute ; petals about as long as the calyx, the standard ovate, silky tomentose, without tomentum on the upper portion ; wings and keel equal, the latter terminating in a straight or slightly twisted beak, ciliolate on the margins ; ovary sessile, glabrous ; ovules numerous (30–40) ; pod much inflated, sessile or shortly stipitate.

Base of Inglis' Gap, King Leopold Ranges (W.V.F.).

Height 1–2ft.; leaves 1–2in. long.; stipules 2-3 lines long; flowers pale-yellow, copiously dark-spotted; calyx 8 lines long; standard 4 lines across; pod 1in. or more in height. In wet grassy spots.

Affinity to *C.* linifolia L.

280. *Psoralea* Archeri F. v M.

Erect, 3-4ft.; flowers pink. This tropical species is also in Papua.

281. *P.* cuneata (W.V.F.). n. sp.

A spreading, rigid, and somewhat intricately branched shrub, very hispid, with spreading white hairs, the glandular dots small and almost concealed; leaves unifoliolate, sessile or almost so; leaflets cuneate, with short pungent points and usually several acute or pungent teeth on the margins of the upper half, otherwise entire, very hispid on both pages; stipules slender, recurved, persistent, spinescent; flowers on extremely short pedicels, usually solitary and axillary, rarely in clusters of 2-3; calyx very hispid with white spreading hairs, the upper and lateral lobes as long as the tube, the lower lobe narrowly boat-shaped and much longer than the others; corolla as long as the lower calyx-lobe; standard glabrous; keel obtuse; pod included in the somewhat inflated calyx, ovate, obtuse, glandular and very hispid, especially near the apex.

Bases of Mts. House and Clifton; King River (W.V.F.).

Height 2ft.; leaflets $\frac{1}{2}$in. or less in length.; stipules two lines long; calyx $3\frac{1}{2}$–4 lines long; corolla purple.

On shady rises associated with species of *Triodia* (Spinifex).

Affinity to *P.* Archeri, F. v. M.

282. *P.* balsamica F. v. M.

Erect, 3-5ft.; strongly scented; flowers purplish; ovary glabrous.

283. *P.* virens (W.V.F.). n. sp.

Stems erect, slender, green and glabrous, with small brown glandular dots, few-branched; leaves on slender petioles, rarely unifoliate; leaflets lanceolate to ovate-lanceolate, mucronate-acute, entire, almost membranous, green and quite glabrous on the midrib, beneath scanty hispid, gland-dots minute and copious; stipules very small, setaceous; flowers on slender pedicles which are shorter than the calyces, in globular or ovoid shortly pedunculate racemes, axillary or, through leaf suppression, forming long terminal racemes; the peduncles, pedicels, bracts and calyces sericeous, bracts shortly and broadly ovate, hardly acute and, along with the calyx copiously black glandular-

dotted ; calyx—upper lobe shorter than the tube, the lower much broader, almost twice as long as the tube ; corolla slightly longer than the lower calyx-lobe ; wings and keel equal, shorter than the standard ; fruiting calyx open, the pod much shorter than it ; pod ovate glabrous, glandular and rugose.

Summit of Mts. Broome, Harris and Daglish ; Packhorse and Harding Ranges. (W.V.F.).

Height 6–15ft. ; very strongly scented ; petioles $1\frac{3}{4}$in. or less in length. ; leaflets 3in. long or less ; calyx 4 lines long ; corolla purple ; standard 4 lines diameter ; keel very obtuse. In sandy loams overlying quartzite and sandstone.

Affinity to *P.* balsamica F. v. M.

284. *P.* badocana Benth.

Carson's Valley (J. Bradshaw and Allen) ; near Wyndham ; King River (W.V.F.).

Erect, 2–3ft. ; flowers purple.

285. *P.* pustulata F. v. M.

Stems erect, simple or slightly branched, 4–6ft. ; flowers purple.

286. *P.* leucantha F. v. M.

Erect, 2–4ft. ; standard white, the wings and keel white, blotched with purple.

287. *Indigofera* trita L.

Negri River (Alex. Forrest) ; Ord and Isdell Rivers (W.V.F.). Ascending to 6in. in height ; flowers reddish.

288. *I.* trifoliata L.

Prince Regent's River (J. Bradshaw and Allen) ; Isdell, Charnley, and Calder Rivers (W.V.F.)

Stems procumbent or ascending, 6–8in. high, occasionally above 1ft. ; flowers red.

289. *Tephrosia* conspicua W.V.F. n. sp.

An erect shrub, the branchlets, leaves, and inflorescence closely invested with a yellowish velvety tomentum ; leaves petiolate ; stipules narrow, deciduous ; leaflets 3–5, ovate-lanceolate, mucronate, thinly coriaceous, nearly all equal, petiolulate, the primary parallel veins conspicuous, anastomosing near the margins and much reticulate between ; racemes large, in the upper axils ; flowers large, solitary or in clusters of 2–3 ; bracts sericeous, broadly ovate, terminating in long acuminated points ; calyx softly villous, the tube broad ; lobes ovate, acutely acuminate, the lower longer than the tube, the lateral

ones about as long, the two upper connate to above the middle ; standard silky-villous, conspicuously calloused at the base above the claw ; wings shorter ; keel shorter than the wings, incurved, obtuse ; upper stamen and adjoining portion of the staminal tube hirsute ; style flattened, glabrous ; ovary white-tomentose ; pod linear, obliquely pointed, slightly recurved, compressed, pubescent ; seeds lenticular, with a small circular strophiole.

Dillen's Springs (W.V.F.) (J. P. Rogers).

Height 5–7ft. ; leaf-petioles 1in. or more in length ; leaflets 3–4in. long ; petiolules 2 3 lines ; racemes 1ft. long or less ; flowers orange-red ; pedicels 2 4 lines long ; calyx 5 lines long ; standard 8 lines diameter ; wings 6 lines long ; pod 3in. long.

This pretty species grows in sandy loam.

Affinity to *T.* elongata, R. Br.

290. *T.* purpurea Pers.

Shrub, erect, 2–4ft. ; flowers pink.

291. *T.* rosea F. v. M.

Erect, 2–8ft. ; flowers pink.

The taller forms have a silver-white tomentum.

The variability of this species and the existence of numerous intermediates between it and *T.* purpurea Persoon, tend to show that it cannot be even retained as a variety.

292. *T.* flammea F. v. M. var. *monophylla* (W.V.F.) n. var.

Isdell and Lennard Rivers (W.V.F.).

An erect shrub, 8–10ft. high ; leaflets solitary, elliptical-oblong to obovate, obtuse, 1–2in. long ; pod 2 -2½in. long, slightly falcate. In sandy loams.

293. *T.* coriacea Benth.

Lennard and Isdell Rivers (W.V.F.).

Erect to 3ft. ; flowers orange-red. In sandy loam.

294. *T.* leptoclada Benth.

Lennard and Isdell Rivers (W.V.F.).

Pod 1–1½in. long. In sandy soil.

295. *T.* uniovulata F. v. M.

10 miles above Wingrah Pass, on the Lennard River (W.V.F.). Stems erect, almost simple, several together from a thick woody stock, 2–3ft. ; leaves all trifoliolate ; flowers yellowish. In sandy loam.

Port Hedland (W.V.F.).

Stems ascending or erect, under 1ft. ; leaves uni-trifoliolate ferruginous tomentose ; flowers small, clustered, purplish. Sandy soil. The species was previously collected along the Ashburton, Nichol and Cave Cane Rivers, also between Mueller's Range and Ord River (Alex. Forrest).

296. *T.* stipuligera (W.V.F.) n. sp.

A diffuse rigidly-branched shrub, the branchlets and foliage hirsute and the young shoots white-tomentose ; leaves petiolate ; stipules persistent, erect, rather rigid ; leaflets 5-7, linear-cuneate to narrow-oblanceolate, with a small recurved point, very shortly petiolulate, the veins very oblique and occasionally anastomosing ; flowers small, pedicellate or in leaf-opposed clusters of 2–3 ; bracts small, setaceous ; calyx pubescent, the lobes linear, obtuse or subacute, the lower about as long as the tube, the upper connate to the middle ; standard tomentose without ; wings shorter ; keel incurved, very obtuse, shorter than the wings ; ovary densely tomentose ; style glabrous, much compressed ; pod linear, obliquely acute, straight or slightly falcate, the valves flattened, pubescent ; seeds orbicular.

King River (W.V.F.).

Height 2ft. ; leaf-petioles 1–2 line ; leaflets $\frac{1}{2}$-$\frac{3}{4}$in. long ; flowers red ; pedicels 1 line long or less ; Calyx $1\frac{1}{2}$ lines long ; standard $2\frac{1}{2}$ lines diameter pod $\frac{3}{4}$in. long. On basaltic hills.

The foliage is readily eaten by stock.

Affinity to *T.* remotiflora F. v. M.

297. *T.* filipes Benth.

Of straggling habit ; stems 1–3ft. long ; leaflets 3–5 ; racemes 3 to above 6in. long, with numerous pairs of pink or purplish flowers.

298. *T.* remotiflora F. v. M.

Leaflets narrow; to above $1\frac{1}{2}$in. long ; flowers pale pink.

299. *T.* macrocarpa Benth.

N.W. coast (Bynoe) ; Lennard, Fitzroy, Isdell, Adcock, Ord, Denham and King Rivers ; Mt. Leake, Dillen's Springs (W.V.F.).

Diffuse, 3–5ft. high and across, the whole plant sometimes sericeous ; disagreeably scented ; leaflets occasionally solitary ; flowers often in axillary clusters, the standard and wings orange-red to red, the keel always yellowish. In sandy soil.

300. *T.* phæosperma F. v. M.

Dillen's Springs. (W.V.F.)

An erect shrub, 4–6ft. ; racemes often bead-like ; flowers reddish-purple.

In moist sandy loam.

301. *Sesbania* grandiflora Pers.
A tree of 30–40ft. ; trunk 15–20ft. ; diameter 1 -1¼ft. ; bark dark-grey, longitudinally fissured, rough and corky ; timber pale, soft and light ; flowers white or yellowish-white. A "Cork-tree."
In deep black soil adjacent to fresh water.

302. *S.* aculeata Pers., var. *sericea* Benth.
Erect, slender, 3 -5ft. ; flowers yellow, the standard blotched with dark-purple.
In moist sandy soil.
Var. *erubescens* Benth.
Sturts' Creek (W.V.F.), near the junction of the Lennard and Barker Rivers (W.V.F.).
A graceful plant of 6-8ft. in height ; flowers numerous, in lax pendulous racemes ; pale-purple, about ¾in. long. In wet black soil. Apparently a distinct species.

303. *Swainsona* oligophylla F. v. M.
East of Oscar Range (Alex. Forrest) ; Lawlers, Mt. Magnet (W.V.F.).
Stems spreading, under 9in. high ; flowers purple ; calyx-lobes short.

304. *S.* Kingii F. v. M.
Between Gascoyne and Fortescue Rivers (H. S. King) ; Black Flag (W.V.F.).
Of lax ascending habit, the stems 1–1½ft. long ; flowers whitish.

305. *S.* oroboides F. v. M.
May and Lennard Rivers (W.V.F.)
On grassy flats.

306. *S.* unifoliolata F. v. M.
Annual, 2½in. high ; stipules somewhat foliaceous but small ; flowers solitary ; standard purple with darker striæ.

307. *S.* colutoides F. v. M.
Erect, 1–3ft. ; flowers purple ; pods red, much inflated.

308. *Æschynomene* indica L.
Rootstock and stems corky ; erect, 2–3ft. ; flowers yellow.

309. *Desmodium* trichostachyum Benth.
Upper Isdell River (W.V.F.)
Stems prostrate, often covering 1ft. ; flowers white. In wet soil.

310. *D.* neurocarpum Benth., var. *gracile* Benth.
Lennard River, between Napier and King Leopold Range (W.V.F.)
A small tufted plant growing in sandy soil.

311. *Erythrina* vespertilio Benth.

A deciduous tree to 40ft. ; trunk reaching 20ft. ; diameter 1–1½ft. ; bark brown, rough and corky ; timber white, soft, tough ; petals scarlet ; the standard with a dark blotch at the base. A "Cork-tree." In sandy soil.

312. *Canavalia* ensiformis DC.

Base of Mt. Brennan, Adcock and Throssell Rivers (W.V.F.)
Near Pittard's Bluff (W. H. Brown).
Twines over the tops of small trees.

313. *Atylosia* marmorata Benth.

South base of Artesian Range, Isdell River (W.V.F.)
Stems trailing for many yards, or shortly twining ; flowers yellow. In sandy soil.

314. *A.* cinerea F. v. M.

Shrubby, erect, 3 5ft. ; few-branched ; through leaf-suppression the racemes often form terminal panicles ; standard pink or greenish with darker striæ. Specimens from near the junction of the Fitzroy and Hann Rivers (W.V.F.) differ from those of the type in long slender branchlets ; woolly white indumentum, that on the inflorescence often glandular ; racemes sometimes above 4in. long, bearing numerous flowers, on pedicels which are often twice as long as the calyces.

315. *A.* lanceolata W.V.F. n. sp.

An erect shrub with long slender branches, closely invested with an appressed white or yellowish silky tomentum ; leaves petiolate ; leaflets uni-trifoliolate, lanceolate to linear-lanceolate, obtuse, the terminal one shortly petiolulate, the lateral ones shorter or often suppressed, much reticulate beneath, rugose above ; stipules small, linear ; flowers in irregular clusters on short pedunculate axillary, solitary racemes, the uppermost occasionally (through leaf-suppression) forming short terminal panicles ; pedicels much shorter than the calyces ; calyx closely invested with yellowish silky hairs, the lobes lanceolate, longer than the tube ; wings and keel shorter than the standard ; ovules 4–6 ; pod oblong, closely tomentose ; valves coriaceous, with transverse depressions between the seeds ; seeds mottled brown and black.

Mt. Broome (W.V.F.).

Height 4–6ft ; petioles ½–¾in. long ; terminal leaflets 2½–3in. lateral ones 1in. or less in length ; calyx 4–5 lines long ; standard 6–7 lines long, yellow, longitudinally streaked with purple ; wings and keel 4–4½ lines long, yellow ; pod 1¼in. long by ⅓in. broad. Among sandstone and quartzite rocks.

Affinity to *A.* grandifolia F. v. M.

316. *A.* grandifolia F. v. M.
Isdell and Lennard Rivers, Synnot Creek, Dillen's Springs (W.V.F.).
Erect, 3–4ft. high ; standard yellow streaked with green or purple ; wings and keel yellow. In sandy loam.

317. *Rhynchosia* acutifolia Benth.
Erect, much-branched, 3–4ft. ; standard yellow, longitudinally purple striated ; wings and keel yellow. In sandy soil.

318. *R.* australis Benth.
Artesian Range (W.V.F.).
Stems twining for several feet ; standard and wings yellow ; keel greenish. Among sandstone rocks.

319. *R.* rhomboidea F. v. M.
Artesian Range (W.V.F.).
Stems twining or trailing for several yards, often viscid ; standard and wings yellow ; keel greenish. Among sandstone rocks.

320. *Flemingia* lineata Roxb.
Durack River (J. Bradshaw and Allen) ; Isdell and Charnley Rivers, Synnott Creek (W.V.F.).
Erect, few-branched, 3–4ft. ; standard and keel scarlet and green ; wings scarlet.

321. *F.* pauciflora Benth.
Carson's River (J. Bradshaw and Allen) ; Charnley and Calder Rivers (W.V.F.).
Stems erect, almost simple, 1–1½ft. ; several from the same stock ; flowers reddish-purple.

GERANIALES.

ZYGOPHYLLEÆ.

322. *Tribulus* hirsutus Benth.
Nichol Bay (F. Gregory) ; Carnarvon. (W.V.F.).
In sandy loams.

323. *T.* affinis (W.V.F.). n. sp.
Stems slender, prostrate and along with the leaves and pedicels more or less hirsute ; leaves alternate, with 2–5 pairs of almost equal linear or linear-lanceolate leaflets ; stipules linear-lanceolate ; flowers small, on slender pedicels which are thickened upwards ; sepals hirsute ; petals ovate, shorter than the sepals ; stamens five, alternating with five shorter filiform staminodia ; anthers large, ovate ; ovary-cells 1–ovulate ; fruits narrow-pyramidal, the style persistent and forming a straight beak, the cocci hirsute on the back and prominently reticulate on the back and sides.

Near Derby ; Lennard, Barker and King Rivers (W.V.F.). Stems 1–2ft. long. Leaflets, two uppermost 1in. long, the lower slightly shorter. Stipules $1\frac{1}{2}$–2 lines long. Pedicels $\frac{3}{4}$in. or less. Sepals $1\frac{1}{2}$ lines long. Petals yellow. Fruits 4–5 lines long, including the beaks.

In damp sandy spots.

Affinity to *T.* pentandrus Benth.

324. *T.* pentandrus Benth.

King River, Dillen's Springs (W.V.F.).

Prostrate to 6in. ; flowers yellow.

In damp sandy spots.

325. *T.* curvicarpus (W.V.F.). n. sp.

Stock apparently perennial, the stems prostrate or ascending, and, along with the leaves and inflorescence, closely invested with white spreading almost bristly hairs ; leaves alternate ; leaflets 4–5 pairs ; oblong to oblong-lanceolate ; stipules small ; flowers rather large, on slender pedicels ; sepals lanceolate, hirsute without, glabrous within ; petals obovate, glabrous, exceeding the sepals ; stamens 10, alternating filaments short ; anthers on the longer filaments oblong, on the shorter ones ovate ; ovules solitary in each cell ; fruits obliquely pyramidal, more or less curved, the style persistent and forming a straight beak, each carpel hirsute on the back and reticulate or almost rugose on the back and margins ; each bearing a short conical spine about the middle on each side and a longer slightly reflexed one on each side at the base.

Goody Goody, near Derby. (W.V.F.).

Stems 1–3ft. long. Leaflets 3–5 lines long. Pedicels $\frac{1}{2}$–$\frac{3}{4}$in. Sepals 3 lines long. Petals 4 lines long, pale yellow, fruits, including the beaks, 5 lines long.

In dry sandy localities.

Affinity to *T.* bicolor F. v. M.

RUTACEÆ.

326. *Boronia* pauciflora (W.V.F.) n. sp.

An erect much-branched shrub, slightly viscid and glabrous excepting the young shoots and flowers ; leaves simple, ovate-lanceolate, acute, tapering into a short petiole, firm, the margins entire, flat or slightly refracted, mid-rib evident above ; flowers few, solitary, on slender axillary pedicels ; sepals ovate-lanceolate or almost deltoid ; terminating in slender acute tips ; valvate, glabrous ; petals ovate-lanceolate, subacute, valvate, firm, tomentose, slightly shorter than the sepals ; filaments compressed, tomentose, glandular and slightly dilated upwards ; anthers hirsute, apiculate ; ovary viscid and glabrous ; style short, thick hirsute ; cocci slightly reticulate ; seeds wrinkled.

1,000ft.–1,900ft. above the base of Mt. Broome, King Leopold Ranges (W.V.F.).

Height 2ft. Leaves $\frac{3}{4}$-$1\frac{1}{4}$in. long. Pedicels 3 lines or less. Sepals $1\frac{1}{2}$–2 lines long. Petals white. Cocci 2 lines long. Seeds black.

Growing in crevices of quartzite.

Affinity to *B.* grandisepala F. v. M.

MELIACEÆ.

327. *Melia* dubia Cavan.

King Sound District (Froggatt); Wingrah or Devil's Pass, Napier Range, Grant Range. Ord and Denham Rivers (W.V.F.) An evergreen tree of 40-50ft., trunk to 20ft.; diameter 1–$1\frac{1}{2}$ft.; bark brownish, thin and scarcely rugose; timber pale yellow or brownish and straight-grained; flowers white, sweetly scented; fruits pale yellow. In sandy loams. The Australian plant is referred to *M.* composita Willd., in the Flora Australiensis. This is now regarded as a synonym for *M.* dubia. Muller places it under *M.* Azedarach L.

328. *Owenia* reticulata F. v. M.

Near Nichol Bay (Walcott); Ord River (W.V.F.).

A tree of 40ft. in height; trunk to 15ft.; diameter $1\frac{1}{2}$ft.; bark dark brown, rough and moderately thick, usually longitudinally fissured and somewhat corky; timber brown, hard and tough; flowers greenish; fruits purple, globular, often 2in. diameter.

In sandy loam.

The pulp of the fruit is very scanty and of a disagreeable flavour.

329. *O.* verrucosa F. v. M.

A tree to 30ft.; trunk 15ft.; diameter to 1ft.; bark reddish, not very thick, rough and flaky; timber dark brown, very hard and tough; flowers greenish-white; fruits purple, the pulp extremely bitter to the taste.

Among sandstone and quartzite rocks, or on sandy undulations.

POLYGALACEÆ.

330. *Polygala* leptalea DC.

Carson River (J. Bradshaw and Allen); Upper Lennard and Isdell Rivers, north base of Bold Bluff (W.V.F.).

Sometimes almost leafless; flowers pink.

331. *P.* Tepperi F. v. M.

Roebuck Bay (J. W. O. Tepper); near Derby (W.V.F.).

Erect, 1–2ft.; flowers pink; closely allied to the Indian *P.* rosmarinifolia Wight and Arnott.

332. *P.* stenoclada Benth.
Near Derby and at Native Well (W.V.F.).
Erect to 1ft. A form with the foliage of var. *stenosepala* Benth., and the flowers of the type, excepting the stigma. This is not bearded, but there is a small membranous appendage on the underside of the style. The flowers are blue.

333. *Comesperma* sylvestre Lindley.
Isdell, Hann, Barnett, and Charnley Rivers (W.V.F.).
Erect, 1–2ft. On low hills among sandstone and quartzite boulders.

EUPHORBIACEÆ.

334. *Euphorbia* alsiniflora Baill.
Very doubtfully distinct from *E.* myrtoides Boiss.

335. *E.* myrtoides Boiss.
Involucres often on pedicels of $\frac{1}{3}$in. long, and, when so, the gland appendages large and entire.

336. *E.* Wheeleri Baill.
Doubtfully distinct from *E.* myrtoides Boiss.

337. *E.* australis Boiss.
Nichol Bay (M. Brown); Port Hedland, etc. (W.V.F.).
In sandy localities.

338. *E.* Mitchelliana Boiss.
Near Derby (W.V.F.).
In shaded sandy spots.
Var. *stenophylla* Benth.
Near Derby, May, Meda, and Lennard Rivers (W.V.F.).
Leaves and capsules often slightly hirsute. In sandy loam.

339. *E.* distans W.V.F. n. sp.
A glabrous perennial, with straggling or ascending almost wiry dichotomous stems and branches, which along with the leaves are often red-coloured; leaves opposite in distant pairs, oblong or ovate-lanceolate, shortly petiolate and obliquely cordate at the base, obtuse, entire, very thin, on the flowering branches very distant; stipules lobed or slightly fringed; flower heads terminal, 1–2 together on short stout pedicels, the last leaves much exceeding the involucres; involucre slightly hairy, within the margin ciliate with rather long hairs, otherwise glabrous; glands rather broad with much narrower entire appendages; capsule glabrous; seeds marked by very deep transverse furrows; styles shortly bifid.
Base of Mt. Broome (W.V.F.).

Plant 1–2ft. long. Leaves $\frac{1}{2}$–$\frac{3}{4}$in. long. Involucres 1 line long, often red. Appendages of the glands white or reddish. Capsules 1 line long. Heads greyish. In sandy loam and black soil.

Affinity to *E.* Armstrongii Boiss.

340. *E.* Schultzii Benth.

Near Derby, May and Lennard Rivers (W.V.F.).

In sandy loam.

341. *E.* comans W.V.F. n. sp.

An annual or perennial of short duration, with several stems, erect or ascending from the base, much-branched and invested with spreading white hairs: leaves opposite, on extremely short petioles, ovate to ovate-oblong, obtuse, very obliquely cordate at the base, those on the flowering branches gradually smaller, stipules lobed or entire and setaceous; involucres terminal or, in the upper axils, solitary or two together, usually on short branchlets, glabrous, shortly pedicellate the leafy bracts longer than the involucre; glands rather broad, with slightly larger minutely denticulate appendages; capsule prominently angled, glabrous; styles shortly bifid; seeds marked with rather shallow transverse furrows.

Near Derby, Denham and King Rivers (W.V.F.).

Height under 9in. Leaves 3–4 lines long. Involucres about $\frac{1}{2}$ line long. Appendages to the glands white. Capsules under 1 line long. Seeds brownish. In sandy soil.

Affinity to *E.* Schultzii Benth.

342. *E.* Muelleri Boiss.

May, Lennard, Isdell Rivers, near Derby (W.V.F.). In sandy loam.

343. *E.* cinerea W.V.F. n. sp.

A prostrate glabrous and glaucous greyish many-branched plant, the rhizome woody and knotted; leaves opposite, very shortly petiolate, obovate to spathulate, shortly mucronate, oblique and very narrow at the base, entire or finely serrulate in the upper portion, almost imbricate on the flowering branches; stipules conspicuous and deeply lobed; involucres terminal or, in the upper axils, 1–2 together, very shortly pedicellate, glabrous; glands small, with a comparatively broad entire margin; capsule shortly stipitate, glabrous; styles simple; seeds rugulose.

Wingrah Pass, Napier Range (W.V.F.).

Plant covering the ground a foot in diameter. Leaves 2–2$\frac{1}{2}$ 2–2$\frac{1}{2}$ lines long. Involucres under 1 line long. Border of the glands pink, rarely white. Capsules scarcely $\frac{3}{4}$ line long. Seeds reddish-brown.

In moist sandy soil.
Affinity, *E.* Drummondii Boiss. and *E.* alsiniflora Baill.

344. *E.* schizolepis F. v. M.
Prince Regent's River (J. Bradshaw & Allen), near Derby ; May, and Lennard Rivers (W.V.F.).
Capsules scabrous, two lines long, obtusely angled ; seeds large, greyish, covered with numerous irregular white tubercles. In sandy loam.

345. *E.* atoto Forster.
Often a spreading shrub of 1–2ft. high, sometimes slightly tomentose ; leaves frequently scantily serrulated ; gland-appendages white, ovate, larger than the gland. The stipules are mostly setaceous and entire and not fimbriate as in Indian specimens.

346. *E.* chrysochæta W. V. F. n. sp.
An erect scarcely branched annual ; the branches and upper portion of the stem closely invested with rigid spreading shining yellow pointed hairs, intermixed with a scant white crisped pubescence ; leaves opposite, shortly but distinctly petiolate, ovate to ovate-lanceolate, obtuse, very oblique and obtuse at the base, sparingly pubescent on both pages with short white appressed hairs, pale or glaucous beneath, the veins prominent ; stipules small and narrow, lacerate or irregularly fringed ; inserted on a conspicuous transverse stipular line ; floral bracts minute, narrow, lacerate or fringed ; involucres numerous, crowded in bead-like cymes on an evident peduncle in one axil of each pair of leaves, or sessile and terminal, the whole inflorescence invested with short white or yellowish hairs ; involucres small, the glands small and globose with conspicuous but small orbicular entire petal-like appendages ; capsule hirsute ; seeds ovoid, acutely angled and transversely shallow-rugulose.
May, and Lennard Rivers (W.V.F.)
Height 6–18in. Leaves $\frac{3}{4}$–$1\frac{3}{4}$in. long. Involucres 1–3 lines long. Appendages of the glands pale or pink. Capsules $\frac{1}{2}$ line diameter. Seeds pale-brown.
In wet sandy or muddy spots.
Affinity to *E.* pilulifera L.

347. *E.* pilulifera L.
Goose Hill, near Ord River (W.V.F.)
In sandy loam.

348. *E.* eremophila A. Cunn.
The Kimberley form is usually about 2ft. in height.

349. *Antidesma* Ghæsembilla Gaertner.

Careening Bay (A. Cunn.), Isdell and Charnley Rivers; Edkins Range; base of Artesian Range, (W.V.F.)

A tree of 25–40ft.; trunk 5–15ft.; diameter 1ft. or more; bark dark-coloured, rugose; timber pale to brownish, fairly hard and rather tough; fruits red. In moist black or sandy soil.

350. *Briedelia* tomentosa Blume.

Prince Regent's River (J. Bradshaw & Allen). Swan Point (W.V.F.)

An erect shrub of 6–12ft. In sandy soil.

351. *B.* phyllanthoides W.V.F. n. sp.

An erect much-branched shrub, ferruginous-tomentose in every part excepting the flowers; leaves petiolate, ovate, very obtuse, rounded at the base, of firm consistence, the margins somewhat repand, the diverging veins 9–12 pairs, with the fine transverse veinlets very evident; flowers glabrous, monœcious, both sexes together, forming globose axillary clusters which consist of few to many males with 2–3 females; bracts very numerous and rather broad; male flowers sessile or shortly pedicellate; calyx-segments scarcely spreading, deltoid; petals less than half as long as the calyx-segments, several-toothed; disk margin broad and slightly repand; staminal column slender, the free portion of the filaments much shorter, the anthers closely surrounding the abortive tri-lobed pistil; female flowers on short stout pedicels, the calyx-segments narrowly deltoid, obtuse; petals stipitate, obovate, dentate, half as long as the calyx-segments; disk bi-margined, the outer margin flat and slightly repand, the inner surrounding the ovary and consisting of five erect, broad, almost free, slightly denticulate scales; ovary 2-celled; styles 2, recurved, each deeply bifid; young fruits ovate, each cell 1-seeded.

Base of Mt. Broome (W.V.F.).

Height 6–8ft. Leaves 1–1½in. long; the petioles 1–1½ lines. Flowers greenish, segments of the males ½ line long, of the females above ½ line long. In sandy loam under trees.

Affinity to *B.* tomentosa Blume.

352. *Petalostigma* humilis W.V.F. n. sp.

Stems numerous and much-branched, erect from a thickened stock, the plant appearing as a low diffuse shrub, closely silky-pubescent; leaves petiolate, orbicular to broadly ovate, the apices rounded or retuse, rounded at the base, not becoming glabrous with age, flat, the margins entire

or distantly toothed ; stipules minute, setaceous ; flowers dioecious ; males several together, occasionally in axillary clusters but more often in short racemes ; perianth-segments 3 4, broadly obovate, villous ; staminal column invested with long hairs ; the free portion of the filaments and the anthers glabrous ; female flowers solitary, axillary, sessile or shortly pedicellate, the segments 4–6, narrower than in the males ; ovary glabrous, 3, occasionally 4-celled ; styles 3, sometimes 4, glabrous or scantily sericeous, the stigmatic branches broadly ovate, much undulate and crenate ; fruit globular, 3-celled, rarely 4-celled ; seeds smooth.

King River (W.V.F.).

Height 1–2ft. Leaves 1–1½in. long ; petioles 1½–2 lines. Pedicels 1½–2 lines. Perianth-segments 1½ line long. Stigmatic-branches bright-yellow. Fruits 4–5 lines diameter, yellow, extremely bitter to the taste.

In rocky spots.

Affinity to *P.* quadriloculare F. v. M.

353. *Phyllanthus* reticulatus Poiret.

Lennard and Isdell Rivers (W.V.F.).

A bushy shrub, 5–7ft. in height. In sandy localities.

354. *P.* baccatus F. v. M.

Vansittart Bay, Prince Regent's River (A. Cunn.) ; Lennard, Fitzroy, Isdell, Barker, Hann, Charnley, and Calder Rivers, Swan Point, base of Edkins Range (W.V.F.).

Diffuse shrub, 4 6ft. in height. Produces abundance of dark-purple or black fruits.

355. *P.* üerdinandi J. Mull.

Edkins Range (W.V.F.).

A spreading shrub to 20ft. high ; bark grey, smooth ; fruits white. In sandy soil.

356. *P.* üdami J. Mull.

Edkins Range, Sunday Island (W.V.F.).

In crevices of quartzite.

357. *P.* maderaspatensis L.

This is described in the Flora Australiensis as *P.* maderaspatanus L.

358. *P.* polycladus W.V.F. n. sp.

A spreading twiggy shrub, glabrous and somewhat glaucous, the branchlets slender and terete ; leaves almost distichous, shortly petiolate, oblong to lanceolate, acute, rounded at the base, more or less concave, the midrib alone evident ; stipules minute, setaceous ; flowers monoecious, axillary, on slender pedicels, the segments 6, the outer ones ovate,

acute, the inner anrfower and not longer ; male flowers ; anthers erect on a small column formed by the connate filaments, the cells parallel ; glands minute ; female flowers—disk repand ; ovary glabrous and smooth ; styles three, entire, erect ; capsule depressed globular, smooth ; seeds marked on the backs with about six longitudinal striae.

Edkins Range (W.V.F.).

Height 2ft. Leaves 3–4 lines long. Stipules dark-brown. Flowers pale-coloured ; pedicels 2 lines or less. Perianth-segments $\frac{1}{2}$ line long. Capsules 2 lines diameter. Seeds dark-brown. In the crevices of sandstone and quartzite rocks.

Associated with *P.* maderaspatensis L., and with affinity to that species.

359. *P.* minutifolius F. v. M.

York Sound (A. Cunn.) ; near Mt. House, Adcock and Isdell Rivers, north base of Mt. Brennan (W.V.F.).

Some specimens have seeds varying from smooth to muricate. In wet spots.

360. *Flueggia* microcarpa Willd.

An erect twiggy shrub, 4 10ft. ; flowers and fruits white.

361. *Mallotus* nesophilus F. v. M.

Roebuck Bay (J. W. O. Tepper) ; Fitzroy, Isdell, Old, Denham, and King Rivers ; Dillen's Springs, Swan Point (W.V.F.).

A tall shrub to a spreading tree of 30ft. ; trunk to 10ft. ; diameter 9in. ; bark grey, smooth and thin ; timber pale to brownish and not very hard, straight-grained ; fruits orange-red. In sandy soil.

362. *M.* derbyensis W.V.F. n. sp.

An erect shrub with long lax branches, glabrous excepting the petioles or the branches and leaves scantily invested with a short stellate tomentum ; leaves alternate, ovate-lanceolate, rather abruptly acuminate, rounded at the bases of the petiolate leaves, the petioles much thickened upwards, finely and regularly denticulate, the glands numerous and white on the under surfaces, prominently tri-nerved, rarely 5-nerved at the bases, with usually 5–7 pairs of nerves above the basal ones, the parallel veins numerous and conspicuous ; racemes short, scantily stellate tomentose ; capsule tomentose and muricate with short tomentose, closely approximated processes ; seeds subglobose.

Derby (W.V.F.)

Height 10–15ft. Leaves mostly 4in. long by $1\frac{1}{2}$–$1\frac{3}{4}$in. broad. Flowers not seen. Capsules about 3 lines diameter. Seeds brown. In sandy soil.

363. *Excaecaria* agallocha L.
Wyndham (W.V.F.).
An erect deciduous shrub, 6–10ft. high. In tidal muds.

364. *E.* parviflora J. Müll.
Nine-Mile Ridge, nine miles from Wyndham (W.V.F.).
A tree (often deciduous) of 40ft. ; trunk to 20ft. ; diameter 1–1½ft. ; bark greyish, smooth or somewhat rugose ; timber pale-coloured and not very hard. Yields quantities of an acrid milky juice. On saline flats. "Gutta Percha-tree."

SAPINDALES.

ANACARDIACEÆ.

365. *Buchanania* oblongifolia W.V.F. n. sp.
A small tree with stout spreading branches, the young shoots and inflorescence villous or rusty-tomenose, otherwise glabrous ; leaves oblong or ovate-oblong, obtuse or almost rounded, gradually tapering into a petiole, coriaceous and rather rigid, pale-green and hardly shining, veins rather fine but prominent on both sides, much diverging and conspicuously reticulate between ; panicles lax, much shorter than the leaves, few to many together, terminal, subterminal or occasionally axillary, many-flowered, the peduncles and pedicels rather slender ; bracts ovate ; bracteoles lanceolate, and, like the bracts small ; pedicels short ; sepals five, almost orbicular, ciliate, longer than the tube and nearly half as long as the petals ; petals five, elliptical, obtuse ; filaments subulate ; fruits broadly ovate ; slightly compressed, tomentose.
Mt. Rason, between Precipice and Isdell Ranges, Hann, Barnett, Isdell, King, and Ord Rivers, Bell Creek, near Wyndham (W.V.F.).
Height to 30ft. ; trunk to 10ft. ; diameter 1ft. Bark not very thick or rough, dark-coloured, becoming somewhat corky on old trees, the inner with a purple sap. Timber pale, not hard, and rather tough. Leaves 4–6in. long by 1–2in. broad ; petioles ½–¾in. long. Flowers pale-yellow, sweetly-scented. Sepals under 1 line long. Petals 2 lines long. Fruits purplish, 3–4 lines diameter. In stony and sandy localities.
Affinity to *B.* lucida Blume.

366. *B.* latifolia Roxb.
Between Bell Creek and the King Leopold Ranges (W.V.F.).
Tree of 30ft. ; trunk to 10ft. ; diameter 1ft. ; dark greyish to reddish, scarcely rugose ; timber pale, soft and tough ; branches stout and spreading ; flowers pale yellow odorous.

Among sandstone and quartzite rocks.
The species has not hitherto been recorded as Australian.

CELASTRINEÆ.

367. *Celastrus* Muelleri Benth.
Edkins Range (W.V.F.).
A deciduous tree to 25ft. ; trunk 8-10ft. ; diameter about 1ft. ; bark greyish, rugose, rather thick and often corky ; timber pink, close-grained, but rather soft ; leaves ovate to broad-lanceolate, obtuse, or often retuse with a small point in the sinus, $\frac{3}{4}$-1$\frac{1}{2}$in. long ; flowers yellow.
On quartzite hills.

368. *Denham* obscura Meissn.
York Sound (A. Cunn) ; Cambridge Gulf, Mts. Herbert, Leake, Rason ; Packhorse, Isdell, Synnott, Artesian, Edkins, and Harding Ranges (W.V.F.)
A tree 20–30ft. ; branches pendulous ; trunk to 15ft. ; diameter 6–9in. ; bark dark-grey and roughish or grey and smooth ; timber pale yellow, closely grained but fairly soft ; flowers yellow ; fruits lemon-yellow.
In sandy soil.

369. *Stackhousia* muricata Lindley.
The Kimberley plant is often quite leafless and bears yellow flowers and small quadangular fruits.

SAPINDACEÆ.

370. *Atalaya* variifolia F. v. M.
A tree of 30–40ft. ; trunk to 15ft. ; diameter 6-9in. ; bark grey, rugose ; timber pale yellow and not very hard ; flowers and fruits pale yellow or almost white.
In sandy loams.
The foliage is readily eaten by stock.

371. *A.* hemiglauca F. v. M.
A bushy shrub to a tree of 20ft. ; trunk to 5ft. ; diameter 6in. ; bark dark grey, thin, smooth or scarcely rough ; timber white and rather soft ; flowers and fruits white.
In sandy loam.

372. *Dodonaea* lanceolata F. v. M.
Erect, 2–4ft. ; seeds black and shining.

373. *D.* physocarpa F. v. M.
Lennard and Isdell Rivers ; Mt. Behn (W.V.F.).
Diffuse, 3–4ft. high.
In stony spots.

374. *D.* platyptera F. v. M.
Shrub to a tree of 30ft. ; trunk to 10ft. ; diameter 6in. ; bark grey, thin, rather rough and fibrous ; timber dark brown and hard.
In sandy loams.

375. *D.* polyzyga F. v. M.
An erect shrub of 5-15ft. in height ; sepals ovate-lanceolate, obtuse, 2 lines long ; anthers 10-12, linear, sparingly hirsute, shorter than the sepals ; style often elongated.
In sandy loam.

376. *Distichostemon* phyllopterus F. v. M.
Shrubby, 4-6ft. high, with the habit and appearance of a species of *Thomasia* ; anthers hirsute ; style red, to 1in. long ; fruits purplish when ripe.
In sandy soils.

377. *Cardiospermum* halicacabum L.
Fitzroy and Hann Rivers. (W.V.F.).
Stems twining to 3ft. ; flowers white ; fruits inflated, angled or winged.

RHAMNALES.

RHAMNEÆ.

378. *Ventilago* viminalis Hook.
Roebuck Bay (J. W. O. Tepper) ; Isdell River ; between Erskine Range and Mt. Marmion (W.V.F.).
An evergreen tree of 30ft. ; trunk to 15ft. ; diameter 1ft. ; bark dark grey, not very thick, but roughish and longitudinally fissured ; timber brown, tough and very hard ; flowers and fruits yellow. "Steel-wood."
In sandy scrubby country ("Pindan").

379. *Alphitonia* excelsa Reissek.
Isdell and Charnley Rivers. (W.V.F.).
An erect bushy shrub of 8–20ft. ; flowers white, fruits black, globular, 4 lines in diameter.
In sandy loam.

380. *Cryptandra* intratropica (W.V.F.) n. sp.
An erect twiggy, thornless shrub, rusty or villous-tomentose ; leaves usually clustered, cuneate, oblong to obovate, obtuse ; tapering into short slender petioles, the margins sharply refracted, stellate-tomentose above, very villous beneath, the midrib prominent ; stipules setaceous, brown, persistent ; flowers from few to many ; in axillary clusters or headlike racemes, sometimes forming a short narrow terminal panicle through one leaf-suppression, each flower

on a slender pedicel much shorter than the calyx, with five or more imbricate brown pubescent bracts surrounding the base of each pedicel, and about as long as it ; calyx tomentose, small, enlarging in fruit, the adnate base as long as the free portion, almost turbinate in outline ; lobes pale-coloured, slightly longer than the tube, usually connivent ; ovary densely pubescent, 2-celled, the summit rounded and conspicuously raised above the adnate portion of the calyx ; style minutely lobed : fruit crustaceous, obovoid, or almost turbinate, dividing into two cocci, each one dehiscing into two valves.

1,000ft. or more above the base of Mt. Broome (W.V.F.). Height 2-3ft. ; leaves 3-5 lines long; calyx scarcely one line in flower, 2 lines or more when in fruit. Differs from *Cryptandra* proper in the constantly 2-celled ovary and in the fruits. In these characters it accords with *Trymalium Wichurae* Nees., with the foliage and habit of *Spyridium* and the inflorescence and flowers of *Cryptandra*.

It is the only species recorded from the tropics and does not appear to have any near ally.

Occurs in crevices of quartzite along with *Boronia pauciflora* W.V.F.

VITACEÆ (AMPELIDEÆ).

381. *Vitis* adnata Wall.

Vicinity of Isdell, Hann, and Charnley Rivers ; Bold Bluff ; Artesian Range (W.V.F.) Sheba Hills, near Fitzroy River (W. H. Brown).

Climbing among sandstone and quartzite rocks to a height of 3–5ft.

382. *V.* trifolia L.

Durack River (J. Bradshaw and Allen) ; Ord River (W.V.F.).

Climbing to 20 or more feet.

In sandy loam.

MALVALES.

TILIACEÆ.

383. *Grewia* breviflora Benth.

An erect, twiggy shrub, 6–10ft. ; flowers white.

384. *G.* anthopetala F. v. M.

Charnley River (W.V.F.). An erect shrub, 4–6ft. ; flowers pale yellow.

385. *G.* polygama Roxb.

Carson River (J. Bradshaw and Allen) ; Lennard, Fitzroy, Isdell, Charnley and King Rivers ; Synnott Creek ; Dillen's Springs (W.V.F.).

Erect, 3–4ft. ; flowers white ; fruits red and distinctly 4-lobed.

386. *Corchorus* Walcottii F. v. M.
Capsules 4-celled, or by abortion 2-celled.

387. *C.* vermicularis F. v. M.
Lennard, Isdell, and Hann Rivers (W.V.F.)
A form differing from the Victorian River specimens in the tomentose ovary. Erect, 1–1½ft.

388. *C.* elachocarpus F. v. M.
Port Hedland (W.V.F.)
Erect, about 1ft. high.

389. *Triumfetta* plumigera F. v. M.
Erect, varying from 6in. to 4ft. in height; leaves crenate-serrate; ovary sometimes 3-celled.

390. *T.* appendiculata F. v. M.
Nichol Bay (F. Gregory); Lennard and Barker Rivers (W.V.F.).
Diffuse, 3–5ft. high; flowers yellow.

391. *T.* reflexa (W.V.F.). n. sp.
A diffuse shrub, the branches densely invested with dark-coloured or yellowish stellate hairs; leaves petiolate, oblong to lanceolate, obtuse, rounded or shortly tapering, dark-green, invested with rigid stellate hairs; scantily above, densely below; flowers few, pedicellate, forming shortly pedunculate cymose-racemes; buds almost globose and umbrella-shaped owing to the prominent reflexed calyx-appendages; calyx densely tomentose; sepals linear, the tips inflected and acute, appendages affixed immediately below the tips, reflexed, with many prominent teeth or lobes; petals obovate, as long as the sepals; stamens indefinite; fruits ovate-globose, apparently indehiscent, densely villous, coarsely tuberculate and terminating in a 6-lobed point, 6-celled, each cell 1-seeded.
Isdell River, near Grace's Knob (W.V.F.)
Height 4–8ft. Leaves ¾–1½in; petioles 3–4 lines long. Pedicels 1–2 lines. Calyx 5 lines long; appendages 1½ lines by 1 line broad. Petals yellow. Fruits 4 lines long. Seeds brown.
In sandy spots.
Affinity to *F.* appendiculata F. v. M.

392. *T.* glaucescens R. Br.
Fitzroy River, Dillen's Springs (W.V.F.).
A spreading shrub, 2–3ft. high; fruits on recurved pedicels, ovoid-globose, 3–4 lines diameter, tomentose, muricate with fine prickles which are longer than the tomentum, endocarp hard, 3-celled, each cell 1-seeded; seeds brown.
In sandy loam.

MALVACEÆ.

393. *Malvastrum* spicatum A. Gray.

Ord River (Alex. Forrest) ; Lennard River (W.V.F.). Among limestone rocks.

394. *Sida* virgata Hook.

Erect, 3–4ft. ; tomentum often intermixed with long spreading hairs ; carpels 10.

395. *S.* subspicata F. v. M.

Roebuck Bay (J. W. O. Tepper) ; Broome, Derby, Lennard, Adcock, and Calder Rivers, Inglis' Gap, King Leopold Ranges (W.V.F.).

Erect or spreading, 2 4ft. high ; flowers bright yellow. In poor sandy soil.

396. *S.* echinocarpa F. v. M.

Nichol Bay (Alex. Forrest) ; Port Hedland (W.V.F.).

Erect, 3ft. ; pedicels sometimes nearly 1in. long.

397. *S.* Hackettiana W.V.F. n. sp.

A spreading stellate-pubescent shrub ; leaves from cordate-ovate to ovate lanceolar, obtuse, of soft texture, crenate-serrate, on slender petioles which are shorter than the laminae ; stipules subulate ; flowers small, sessile, solitary but closely approximated, forming axillary and terminal simple or branched spikes, the whole inflorescence forming terminal panicles, leafy at the base with each flower subtended by a persistent bract, which is divided to below the middle into 3 linear lobes ; calyx slightly angular when in bud, densely stellate tomentose without ; invested within with long silky hairs ; divided to below the middle into lanceolar acute lobes ; petals slightly longer than the calyx, the claws woolly-ciliate ; staminal column slender, glabrous ; filaments thin, eight ; anthers almost exserted ; style-branches exserted, filiform ; stigmas capitate ; fruit small, included in the calyx, conical, silky-hairy ; carpels 5, obscurely reticulate on the back and sides ; seeds glabrous.

Wingrah Pass, Napier Range (W.V.F.).

Height 3–5ft. Leaves 1–3in. long. Stipules 4–5 lines long. Bracts 2-3 lines. Calyx 3 lines long. Petals yellow. Seeds brown. On limestone. Named in memory of the late Sir Winthrop Hackett, of Perth, Western Australia.

Affinity to *S.* subspicata F. v. M.

398. *Abutilon* Andrewsianum W.V.F. n. sp.

An erect biennial or perennial, closely invested with a short velvety tomentum with which is occasionally mixed a few long spreading hairs ; leaves ovate-cordate, obtuse, the margins irregularly crenulate, the petioles exceeding the laminae ; stipules minute, subulate-linear, fugacious ; peduncles axillary sometimes terminally clustered or forming terminal racemes through leaf-suppression, 1-flowered, articulate about the middle, always longer than the leaves ; calyx campanulate, divided to the middle, the lobes broad, obtuse, obscurely 1- rarely 3-nerved ; corolla glabrous, the tube shorter than the calyx ; staminal column short, glabrous, the filaments free and numerous ; capsule stellate-tomentose, almost truncate ; carpels 8–10, the outer edges terminating in short divaricate points, not readily separable at maturity ; seeds two in each carpel, minutely stellate-tomentose.

Derby ; Lennard, Barker, Fitzroy, Adcock, Hann, and Isdell Rivers (W.V.F.).

Height 5–6ft. Leaves $1\frac{1}{2}$–4 lines long. Calyx 3–$3\frac{1}{2}$ lines long. Corolla $\frac{1}{2}$–$\frac{3}{4}$ inch long, yellow. Capsule 4–5 lines long. Seeds brown. In sandy loam. Named after Mr. Cecil Andrews, Inspector General of Schools, Western Australia.

Affinity to *A.* indicum G. Don.

399. *A.* propinquum W.V.F. n. sp.

A spreading shrub, closely invested with a short viscid velvety pubescence intermixed with long spreading white hairs ; leaves cordate-ovate, obtuse or minutely apiculate, margins serrulate, thin, of soft texture, velvety-pubescent on both pages, the petioles slender and shorter than the laminae ; stipules setaceous ; peduncles axillary, solitary or through leaf-suppression forming small terminal racemes, articulate above the middle, longer than the leaves and all 1-flowered ; calyx divided to two-thirds of its length into ovate-lanceolar, acute, prominently 1-nerved lobes ; corolla glabrous without, the tube short, hirsute at the base within ; staminal column shorter than the corolla, more or less hirsute ; filament short, numerous ; capsule hirsute, nearly truncate ; carpels 10, not readily seceding from the axis, the outer edges terminating in short divaricate points ; seeds glabrous.

Wingrah Pass, Napier Range (W.V.F.).

Height 3–5ft. ; leaves $2\frac{1}{2}$in. long, much reduced upwards. Stipules 3 lines. Calyx about 3 lines long. Corolla 4 lines long, yellow. Capsule 4–$4\frac{1}{2}$ lines long. Seeds brown. Among limestone.

Affinity to A. Andrewsianum W.V.F.

400. *Fugosia* populifolia Benth.
Stems prostrate for several yards ; leaves ovate-cordate, obtuse or shortly acuminate ; corolla fully 2in. long.

401. *Hibiscus* microchlaenus F. v. M.
Erect, 2–3ft. ; branches spreading ; flowers bluish-purple with a darker centre.

402. *H.* pinonianus Gaudich.
Erect, 2–4ft. ; leaves mostly entire ; bracteoles often equalling or exceeding the calyx ; flowers pink to purple with a darker centre.

403. *H.* trionum L.
Erect, few-branched, 2–4ft. high ; leafless or with few tri-lobed leaves ; flowers white with reddish-purple centre. On grassy plains.

404. *H.* ficulneus L.
Lennard, Barker, Fitzroy, and Isdell Rivers (W.V.F.).
Erect, 2–4ft. high.

405. *H.* zonatus F. v. M.
Erect, 4–8ft. high ; flowers sometimes 2½in. across, pink to rose-red with a purple centre ; seeds black, tuberculate.
Var. *spinulosa* W.V.F. n. var.
Mt. Broome, King Leopold Ranges (W.V.F.).
Stems simple or slightly branched, 2–3ft. high, more or less invested with short sharp spines, arising from tubercles, and associated with a short stellate pubescence. Among quartzite.

406. *H.* Sturtii Hook.
Erect, 2–3ft. high ; flowers violet, with a darker centre.

407. *H.* cannabinus L.
Lennard and Isdell Rivers ; Bell Creek (W.V.F.).
Stems erect, almost simple, 4–6ft. high; gland on the underside of the leaf, midrib large ; flowers white to pale pink with a purple centre. This species is described in the Flora Australiensis under *H. radiatus* Cav. The Kimberley specimens differ from the type in the stems being quite devoid of prickles and in having a gland on the back of each calyx-lobe.
In good soil.

408. *H.* Gibsoni Stocks.
Lennard River, between Napier and King Leopold Ranges ; Charnley and Sprigg Rivers (W.V.F.).
Of straggling habit, the herbaceous stems 3–6ft. long ; setaceous bracteoles much longer than the calyx ; sepals almost acute ; corolla yellow with a purple centre ; often dying to a metallic green ; seeds black, sparingly hispid. Sandy loam. Includes *H.* pentaphylla F. v. M.

409. *H.* geranioides (A. Cunn.).

Vansittart Bay (A. Cunn.) ; Native Well, between Derby and Meda Station (W.V.F.).

Erect, sparsely branched, 2–3ft. high ; calyx lobes 1-nerved, corolla white with a dark centre, sometimes scarcely exceeding the calyx ; capsule sparingly hispid at the summit ; seeds slightly silky.

In dry sandy soil.

410. *H.* vitifolius L.

Wingrah or Devil's Pass, Napier Range (W.V.F.).

Erect, 3–5ft. high ; tomentum intermixed with scattered tubercles from which arise simple or trifid setulose bristles ; bracteoles 8 ; flowers yellow with a darker centre.

Brockmania (W.V.F.) n. gen.

Bracteoles free. Calyx 5-lobed. Staminal column with 5 anthers surrounding the summit. Ovary 5-celled, each cell 2-ovulate, the ovules ascending. Style-branches 5, slender, stigmatic along the inner side. Capsule membranous, 5-valved, loculicidally dehiscing and seceding from the short axis, each valve with 1 perfect seed.

The genus is named in memory of the late Mr. F. S. Brockman, Surveyor General of Western Australia.

411. *B.* membranacea (W.V.F.). n. sp.

An erect or ascending annual ; stems green, scantily invested with spreading or slightly recurved setulose bristles ; leaves membranous, broadly cordate-ovate to orbicular, obtuse, entire or broadly 5-lobed, coarsely and irregularly toothed, glabrous or scantily setulose on both pages, the petioles slender, shorter than the laminæ ; stipules linear, setular pointed, deciduous ; pedicels solitary in the upper axils, reflexed, shorter than the leaves, articulate about the middle, bracteoles 8–10, linear, longer than the calyx, rigid, setular-margined ; calyx broadly campanulate, enlarged in fruit, lobed to the middle, the tube 10-ribbed, the ribs setulose, membranous and glabrous between the lobes, ovate, acuminate, with a prominent midrib and thickened margins both setulose ; petals broadly obovate, glabrous, slightly exceeding the calyx ; staminal column glabrous, short, the filaments short or none ; style divided to below the middle into three lobes, two of which are again deeply divided ; capsule enclosed in the enlarged calyx, globular, obtuse ; seeds reniform, glabrous or scantily tomentose, tuberculate.

Banks of Lennard River about 10 miles above Wingrah Pass (W.V.F.).

Height 1ft. or less. Leaves $1\frac{1}{2}$–2in. long. Calyx scarcely 3 lines in flower, above 6 lines in fruit. Petals white or pink. Capsule glabrous. Seeds about 2 lines long, dark brown.

In wet soil.

412. *Thespesia* lampas dalz et Giles.

Lennard, May, Isdell, Barker, Adcock and Calder Rivers (W.V.F.).

Erect, 5–10ft.; corolla to $2\frac{1}{2}$in. long, yellow with a darker centre. Sandy loam. The above are the only known Australian localities. The second species, which is common in Queensland and the Northern Territory, is also in North-West Australia.

413. *Bombax* malabaricum DC.

Careening Bay (A. Cunn.); Artesian and Edkins Ranges (W.V.F.).

A deciduous tree, 50–60ft. high; trunk to 30ft.; diameter 2ft.; bark greyish, not thick, almost or quite smooth, both on the trunk and limbs covered with stout prickles: timber pale, soft and light; flowers crimson, to $3\frac{1}{4}$in. long. "Kapok tree."

On sandstone and quartzite elevations.

414. *Adansonia* Gregorii F. v. M.

From 30–50ft. high; trunk 15–20ft.; diameter to 20ft.; much contracted upwards; branches stout, few; bark grey or brownish, smooth; timber white and spongy; flowers white, above 4in. long, sweetly scented; fruits 6–9in. long by 5–7in. across, brownish to black; seeds dark brown. "Baobab."

Trees often leafless when in fruit. Stock readily eat the young foliage, and the acid floury contents of the fruits along with the seeds are eaten by the aborigines, both being made into a kind of bread. Occasionally the larger trees have deep hollows at the base of the main branches in which is stored quantities of drinkable water which is utilised by the aborigines during dry periods. The species being a tardy reproducer, young plants are very seldom seen.

The trees evidently attain a great age, because there is no authentic record of one being found dead. An inhabitant of sandy loams overlying quartzite or sandstone.

STERCULIACEÆ.

415. *Sterculia* quadrifida R. Br.

Artesian and Edkins Ranges (W.V.F.).

A deciduous tree, 30–40ft. in height ; trunk to 15ft. ; bark greyish, smooth, rather thick ; timber whitish, soft ; follicles orange-red ; seeds black and shining.

On sandstone and quartzite elevations.

416. *S.* incana Benth.

Cambridge Gulf (A. Cunn.), Near Wyndham ; Dillen's Springs (W.V.F.).

A deciduous tree, 20–30ft. high ; trunk 5–10ft. ; diameter 1ft. ; bark dark-grey, roughish ; timber pale, soft and fibrous ; leaves glabrous above when full grown ; flowers in lateral clusters ; calyx broadly campanulate, 1–1½in. long, scarlet, hairy within and without ; lobes induplicate, much shorter than the tube, rounded and spreading, the inner base of the tube bearing a ring of many inflected hairy scales ; staminal column rather short and very hirsute, stigmas linear, and much recurved ; follicles shortly stipitate, ovate-oblong, about 3½in. long, terminating in a short straight beak ; seeds greyish-yellow, smooth. In sandstone and quartzite country.

417. *S.* viscidula W.V.F. n. sp.

A deciduous tree, the branchlets and leaves densely stellate-pubescent : leaves petiolate, broadly ovate, cordate, shortly acuminate, entire, or obscurely trilobed, soft ; flowers large, scarlet, numerous, pedicellate and forming dense short viscid-tomentose cluster-like panicles on the old wood ; calyx broadly campanulate, viscid, stellate pubescent without, simple stellate hairy within, the lobes spreading, broad, obtuse, much shorter than the tube, trinerved, with broad induplicate margins, inner base of the tube thickened into a plate which terminates in a prominent ring of scales, the whole densely hirsute ; staminal column rather long, hirsute, thickened at the base, attenuated upwards ; ovary pubescent, follicles shortly stipulate, obliquely oblong, slightly falcate, terminating in a straight or curved beak, hard and almost woody, densely invested with a yellowish very viscid stellate pubescence, villous within ; seeds numerous, yellowish, smooth.

Near Trig Station, H. 72, Lennard River, and from thence east to the Hann River and north to Calder River (W.V.F.)

Height 15–50ft. ; trunk, 5–10ft. ; diameter to 1ft. Bark dark-coloured and rather rough. Timber pinkish, soft, and fibrous. Leaves 5–7in. long ; petioles 1in.. Pedicels 2–3 lines. Calyx 1½in. long. Follicles 2½–3in. long, beak ½in. long.

In barren localities among granite, quartzite and sandstone country. Occurs in the Northern Territory (M. Holtze).

Affinity to *S.* ramiflora Benth.

418. *S.* tuberculata W.V.F., n. sp.

A small deciduous tree ; branchlets rather stout, and along with the leaves, inflorescence, flowers and fruits closely beset with a greyish stellate pubescence ; leaves petiolate reniform-cordate, entire or obscurely trilobed, chartaceous, flowers dull pink, sessile or almost so, forming dense clusters on the previous year's wood ; calyx broadly campanulate, chartaceous, the inner base of the tube bearing a ring of 5 conspicuous incurved broad trifid white woolly scales ; lobes induplicate, much shorter than the tube, spreading, rounded, trinerved ; staminal column fusiform densely hirsute ; ovary pubescent, the styles linear and somewhat recurved ; follicles sessile or very shortly stipitate, ovoid to obliquely oblong, terminating in a short straight stout beak, and thickly covered with prominent conical protuberances, villous within ; seeds numerous, greyish-yellow, smooth.

Valentine Creek, near Ord River (W.V.F.).

Height 15–20ft. ; trunk to 8 ft. ; diameter 6–9in. Bark dark-grey, and somewhat rough. Timber pale pink, soft and fibrous. Leaves 4–5in. long by 5–7in. across ; petioles $1\frac{1}{2}$–$2\frac{1}{2}$in. long. Calyx 1in. long. Follicles $2\frac{1}{2}$–$3\frac{1}{2}$in. long. Among quartzite rocks.

Affinities to *S.* ramiflora Benth., and *S.* viscidula W.V.F.

419. *S.* ramiflora Benth.

From a shrub to a tree of 35ft. in height ; trunk to 10ft. ; diameter 1ft. ; bark thick, rough, greyish, inner fibre tough ; timber pale, soft and fibrous ; leaves often glabrous above, frequently absent when the plant is in flower ; flowers scarlet ; staminal column sometimes pubescent to the apex ; follicles to 5in. long, on a stipes of $\frac{3}{4}$–1in. long.

420. *S.* viridiflora W.V.F., n. sp.

A deciduous shrub or oftener a tree ; leaves on slender petioles, broadly cordate-ovate or orbicular, very obtuse or rounded at the apex, entire or obscurely trilobed, thin, closely invested on both pages with a short greyish stellate pubescence ; flowers green, with occasionally pinkish margins to the lobes ; few almost or quite sessile on the previous year's wood ; calyx broadly campanulate, stellate tomentose without and within lobed to almost the middle, the lobes broad obtuse, with narrow induplicate margins, trinerved ; within the base of the tube is a thickened plate which terminates in a ring of densely

hairy scales ; staminal column densely stellate tomentose, much thickened downwards ; ovary closely hirsute ; follicles very shortly stipitate, ovate-oblong, terminating in a short obtuse beak, closely invested with yellowish stellate hairs ; seeds numerous, pale yellow, smooth.

Gorges near the Isdell River ; summits of Isdell and Edkins Ranges ; Mt. Rason (W.V.F.).

Height 10–30ft. ; trunk to 10ft. ; diameter to 1ft. ; bark greyish, smooth. Timber pale pink, fibrous, soft. Leaves 2–3in. long ; petioles $1\frac{1}{2}$in. or less. Calyx $\frac{3}{4}$–1in. long. Scales $1\frac{1}{2}$–2 lines long. Follicles 3–$3\frac{1}{2}$ lines in length. Among sandstone and quartzite boulders.

Affinity to *S.* discolor F. v. M.

421. *S.* Gregorii F. v. M.

Attains a height of over 50ft. ; flowers yellowish-white, pinkish striate. "Kurrajong."

422. *S.* decipiens W.V.F. n. sp.

A deciduous tree, quite glabrous, excepting the flowers ; leaves on long slender petioles ; ovate-cordate from short to long—acuminate, entire or prominently trilobed, the lobes ending in slender acuminate points, veins very divergent ; flowers in short axillary recemes ; calyx broadly campanulate, lobed to the middle, green streaked with purple, densely tomentose without, glabrous within ; staminal column in the male flowers very slender, glabrous except at the base, where it is surrounded by a tuft of straight white hairs, in the female very short, but with a similar basal tuft of hairs ; ovary densely tomentose ; style glabrous, the stigmas almost peltate ; follicles somewhat oblong, glabrous, with a straight or curved beak ; seeds numerous, bright-yellow, smooth and shining, the outer coating densely hairy.

Near Derby and Mt. Harris and in numerous intervening localities.

Height 30 35ft. ; trunk 10 15ft. ; diameter rarely to 1ft. Bark grey, thin, smooth. Timber pale, soft, fibrous. Leaves 3 4in. long. Calyx 5 lines diameter. Style $\frac{3}{4}$in. long. Follicles $2\frac{1}{4}$–$3\frac{1}{4}$in. long by $1\frac{1}{4}$–$1\frac{1}{2}$in. across ; beak $\frac{1}{4}$in. long. reddish-brown. "Kurrajong." In sandy loam.

Affinity to *S.* caudata Heward.

423. *S.* caudata Heward.

An evergreen tree of 30–60ft. in height ; trunk to 25ft ; diameter scarcely 1ft. ; bark greyish, smooth, or slightly rugose ; timber pale, soft, fibrous ; leaves sometimes 6in. long ; follicles dull-red, 2–$2\frac{1}{2}$in. long, inclusive of a broad beak of $1\frac{1}{2}$ lines ; outer coating of the seeds densely hairy, inner smooth and bright-yellow. "Kurrajong." In sandy soils.

424. *Helicteres* rhynchocarpa W.V.F. n. sp.

Stems erect, numerous, almost simple, from a thick woody stock, densely stellate, tomentose; leaves petiolate, acuminate, often apiculate, margins flat, entire, green above, pale beneath, shortly and densely tomentose on both pages; flowers in racemose-paniculate axillary cymes, the peduncles and pedicels very short; calyx obliquely lobed to about one-third of its length, densely stellate-tomentose, the lobes subacute, petals narrow-linear with long slender claws, two slightly broader than the others, glabrous without, pubescent within, with a thickened woolly protuberance extending shortly upwards from the base of the claw, with usually two short lateral teeth lower down; stamens 10, the filaments not long; anthers very small; fruits stipitate, ovate-oblong, densely rusty-stellate; carpels straight, each with a slightly diverging beak, usually 6-seeded; seeds tuberculate.

Synnott Range (W.V.F.).

Height 3ft. Leaves 3 4in. long; petioles 3–4 lines. Calyx 3 lines long. Petals 4 lines long, red. Fruits: stipes 2 lines, carpels 5 lines long, the beaks above 1½ lines in length. Seeds dark-brown. Among sandstone and quartzite boulders (W.V.F.).

Affinity to *H.* incana Benth.

425. *Melochia* pyramidalis L.

King Sound District (Froggatt); May, Lennard, Fitzroy, Barker, Isdell, and Charnley Rivers (W.V.F.).

An erect bushy shrub of 2–4ft.; flowers pink or red.

426. *Dicarpidium* monoicum F. v. M.

Mounts Behn, Herbert, Broome, Leake; Bold Bluff; Synnott, Artesian, Edkins, and Harding Ranges (W.V.F.).

Of straggling habit, the stems and branches wiry; flowers white or pink. Among sandstone and quartzite rocks.

PARIETALES.

ELATINACEÆ.

427. *Bergia* perennis F. v. M.

Sturt's Creek (F. v. M.); Lennard and Isdell Rivers (W.V.F.).

In sandy localities.

FRANKENIACEÆ.

428. *Frankenia* pauciflora DC.

Decumbent and 6–9in. to erect and 2–3ft.; flowers white to pink.

429. *Cochlospermum* heteronemum F. v. M.

Varies from a shrub of 3ft. to a deciduous tree of 30ft. ; trunk to 10ft. ; diameter about 1ft. ; bark greyish-brown, smooth, or slightly rugose, with a very tough inner fibre ; timber pale, soft and light ; branches spreading ; stipules setaceous, $\frac{1}{3}$in. long, caducous ; flowers sweetly scented ; sepals finely ciliolate, pale yellow, streaked with reddish-purple ; petals glabrous, spreading, broadly obovate, deeply emarginate, $\frac{3}{4}$-1in. long, $\frac{1}{2}$-$\frac{3}{4}$in. broad, yellow, streaked with reddish-purple ; stamens very numerous, the filaments 4–6 lines long, 10-15 of the lowest sharply refracted, the balance (60-70) normal ; style bent downwards laciniate ; capsules ovate to ovate-globose, obtuse or slightly depressed, nearly or quite glabrous, brown and reticulate where ripe ; to above 2in. long ; seeds numerous, reniform, brown and rugose, 2 lines diameter.

Distributed throughout Kimberley in sandy and rocky localities and known as "Cotton-tree," or "Kapok-tree." Possibly through misreading a label it is described in the "Flora Australiensis" as *C.* heteroneurum F. v. M.

VIOLACEÆ.

430. *Ionidium* aurantiacum F. v. M.

Ascending or erect to 1ft., branched : flowers orange-red. Growing in stony beds of water courses.

PASSIFLORÆ.

431. *Modecca* australis R. Br.

Stems climbing many yards ; flowers white to pale yellow.

MYRTIFLORÆ.

THYMELACEÆ.

432. *Pimelea* punicea R. Br.

Erect, 6-12in. high ; flowers crimson.

433. *P.* ammocharis F. v. M.

Specimens were collected near the summit of Mt. Leake, Lady Forrest Range (W.V.F.) which are doubtfully referred to this species. The plant is erect, 2ft. high ; leaves $\frac{1}{2}$in. long ; flowers white, hermaphrodite ; perianths persistent. In the crevices of quartzite. Possibly a different species, it is the only one known to be peculiar to that region.

The Section Epallage, as defined in the Flora Australiensis is unsatisfactory.

LYTHRARIEÆ.

434. *Nesaea* repens (W.V.F.). n. sp.

Stems numerous from a perennial rhizome, prostrate or oftener creeping and rooting at the nodes and forming dense patches, hispid with short spreading white hairs, rarely, if ever, glabrous ; leaves opposite, ovate to ovate-lanceolate, obtuse, shortly but distinctly petiolate, entire ; flowers solitary, axillary in the upper axils, on slender pedicels shorter than the leaves ; bracteoles linear, obtuse, shorter than the calyx and not far removed from its base ; calyx ovate-campanulate, 12-ribbed, membranous between, the primary teeth six, very short, triangular, with membranous or white obtuse tips, the sinuses produced into minute almost horizontal accessory teeth ; petals 5–6, rather longer than the calyx, fugacious ; stamens six, the filaments longer than the calyx-tube ; ovary 3-celled ; style slender with a capitate stigma ; capsule globular, nearly as long as the calyx, dehiscing irregularly.

Fitzroy River, near the junction of the Lennard and Barker Rivers (W.V.F.).

Patches from a few inches to nearly 1ft. across. Leaves $1\frac{1}{2}$ lines long. Petals reddish-purple.

In black or sandy loams.

SONNERATIACEÆ.

435. *Sonneratia* alba Smith.

North-West Coast (A. Cunn.) ; Sunday Island (W.V.F.).

A tree of 10 -30ft. ; trunk to 8ft. ; diameter 9in. or more ; bark greyish, smooth : timber pale, very soft ; inner portion of the calyx purple ; petals none ; stamens $1\frac{1}{2}$ -2in. long, white ; angles on fruits very obscure. The Australian plant has been referred to *S.* acida, L. by Bentham and Mueller.

RHIZOPHORACEÆ.

436. *Rhizophora* mucronata Lamarck.

Port Hedland; Derby; Sunday Island; Wyndham (W.V.F.). An erect bush or tree of 15ft.; trunk to 4ft.; diameter 9in.; bark grey, smooth; timber brownish and very tough; flowers white or pale-yellow. A "Mangrove." The bark contains 28 to 40 per cent. of tannic acid.

437. *Ceriops* Candolleana Arnott.

Careening Bay (A. Cunn.) ; Sunday Island (W.V.F.).

Similar in habit to Rhizophora. Timber reddish, tough and hard. A "Mangrove." The bark contains 25 to 32 per cent. of tannic acid.

438. *Bruguiera* gymnorrhiza Lamarck.

Timber pale to brownish, hard and tough; flowers pale purplish. A "Mangrove." The bark contains 25 to 36 per cent. of tannic acid.

COMBRETACEÆ.

439. *Terminalia* platyptera F. v. M.

Goose Hill, Ord, Denham, and King Rivers, near Wyndham (W.V.F.).

An almost deciduous tree of 30ft.; trunk to 10ft.; diameter 6-9in.; bark grey, tessellated; timber brown, tough; fruits sometimes 1¼in. long and including the wings 4in. across. In sandy soil.

440. *T.* volucris R. Br.

Cambridge Gulf (A. Cunn.); near Mt. Marmion; Wyndham; Ord, Denham, and King Rivers (W.V.F.).

A deciduous tree to 30ft.; trunk to 8ft.; diameter 9in.; bark grey, somewhat rough, but often smooth; timber brownish, tough; flowers pale-yellow. In sandy and rocky soil.

441. *T.* circumalata F. v. M.

A bushy tree of 25–40ft.; trunk to 10ft. or more; diameter to 1ft.; bark brownish, rough; timber dark-brown, hard, and tough. "Iron-wood." In poor sandy soil.

442. *T.* bursarina F. v. M.

Lennard, Barker, Isdell, and Hann, Charnley and Calder, Ord, Denham, King, and Durack Rivers (W.V.F.).

A tree to 30 or 40ft.; trunk to 12ft.; diameter 9–12in.; bark brownish to reddish, somewhat rugose and cancellated; timber reddish-brown to dark-brown, very tough, hard; flowers pale-yellow. In the stony beds of watercourses. The trees are oftener leaning than erect from the impact of flood waters and debris.

443. *T.* discolor F. v. M.

Hearson Island, Nichol Bay (F. Gregory's Exped.); between Lennard River and Inglis' Gap (W.V.F.).

A bushy tree of 25ft.; trunk to 8ft.; diameter to 8in.; bark grey and somewhat rough; timber dark-brown, tough and hard, fruits ½-¾in. long, reddish-yellow or almost purple, of a pleasant acidulous flavour. On granite rises.

444. *T.* Hadleyana W.V.F. n. sp.

A small much-branched evergreen tree, the branchlets not very stout and, along with the leaves, more or less invested with short greyish hairs ; leaves alternate, rather crowded at the ends of the branchlets, ovate-orbicular, the apex rounded or retuse, the base obtuse, semi-cordate, or the laminae shortly decurrent, distinctly petiolate, thinly coriaceous, the veins diverging, conspicuous, reticulate between ; spikes solitary, axillary, simple, longer than the leaves, on tomentose peduncles, the rachis scantily hirsute or glabrous, the flowers loosely arranged ; calyx glabrous without, densely white-woolly within ; ovary and style glabrous ; fruit ovate, glabrous ; bluish-purple, more or less conspicuously 2-angled and terminating in a straight or curved beak.

Sunday Island (W.V.F.).

Height 15–20ft. ; trunk to 6ft. ; diameter 6–9in ; bark grey or brownish, somewhat rough ; timber reddish-brown, very tough and hard ; leaves 3–3½in. long, 2¾–3¼in. broad ; petioles slender, ¾–1in. long ; peduncles 1in. ; calyx white, the tube 1¾ lines long, the limb 2½ lines in diameter ; stamens 2 lines ; fruit not above ¾in. long, with a beak of 2–3 lines long. Among quartzite rocks. The fruits have an agreeable subacid flavour and are eaten by aborigines. The species is named in honor of Mr. S. Hadley of the Sunday Island Mission.

Affinity to *T.* porphypocarpa F. v. M.

445. *T.* chlorocarpa W.V.F. n. sp.

Arborescent and evergreen ; branchlets stout and, along with the leaves, quite glabrous ; leaves alternate, broadly obovate, obtuse or retuse, the laminæ slightly decurrent along the petioles, very thin but coriaceous, the veins prominent and diverging and much reticulate between ; spikes usually solitary, axillary, simple, loosely flowered, the rachis densely tomentose ; calyx when in bud closely silky-tomentose, fruit ovate, greenish, densely tomentose, often somewhat rugulose, occasionally obscurely 4-angled but usually without angles or wings, terminating in a short obtuse beak.

Near Goose Hill, Ord River, Dillen's Springs (W.V.F.).

Height 30–40ft. ; trunk to 15ft. ; diameter 1ft. ; bark greyish, thin and rather smooth ; timber brown, hard and tough ; leaves 4–6in. long, 3–5in. broad ; petioles 1in. long ; fruits about 1in. long. In moist sandy loams. The fruits, which have an agreeable subacid flavour, are eaten by aborigines.

Affinity to T. biangulata W.V.F.

446. *T.* biangulata W.V.F. n. sp.

An evergreen tree with a bushy crown ; branchlets stout and, along with the leaves, glabrous or scantily villous ; the young shoots almost villous ; leaves alternate, orbicular or very broadly ovate, obtuse, on stout mealy-pubescent petioles, the laminæ shortly decurrent, coriaceous, greyish, the veins prominent, spreading and much reticulate between ; spikes solitary, axillary, simple, silky-tomentose, scarcely or not exceeding the leaves ; fruit oblong-ovate, densely tomentose, pink, prominently biangular, terminating in a broad obtuse slightly compressed beak which has one or more raised lines on each face.

Hills near Grace's Knob, Isdell River, Packhorse Range, between Isdell, Charnley, and Calder Rivers, near Wyndham, Goose Hill, near Ord River (W.V.F.).

Height 30–40ft. ; trunk to 12ft. ; diameter to above 1ft. ; bark greyish, thin, somewhat rugose ; timber brown, very tough, hard, and heavy ; leaves 4–7in. long ; petioles 1½in. long ; fruits from ¾ to nearly 1in. long, the beak 4 lines long. On sandstone and quartzite elevations. The fruits are subacid to the taste and are eaten by birds.

Affinities to *T.* chlorocarpa W.V.F., and *T.* platyphylla F. v. M.

447. *T.* platyphylla F. v M.

Fitzroy, Lennard, Isdell, Hann, Adcock, Throssell, Barnett, Charnley, Calder, Barker, Ord, King and Denham Rivers ; Walcott Inlet ; Bell, Synnott, MacNamara, and Harris Creeks (W.V.F.).

A tree of 40–50ft. ; trunk to 20ft. ; diameter 1–1½ft. ; bark dark-grey, rough, longitudinally fissured ; timber rather pale-coloured and not very hard ; flowers white to pale-yellow ; fruits pink when ripe, exangular, ¾in. long, narrow-ovoid, terminating in a thick straight beak of above 2 lines long. "Pear-tree." Along banks of streams in deep black soil.

448. *T.* petiolaris A. Cunn.

A shady tree of 30–35ft. ; trunk to 10ft ; diameter 1ft. or more ; bark dark-grey, rather rough ; timber pale-coloured and moderately hard ; leaves to 4in. long, crowded at the ends of the branchlets ; spikes solitary, axillary, simple, shorter than or equalling the leaves on peduncles of 1in. long, which, along with the rachises, are closely silky-tomentose ; flowers white, not crowded ; calyx glabrous without, the adnate tube about 1½ lines

long; the limb 2 lines diameter, white-woolly within; stamens 2 lines long; style and ovary glabrous; fruits narrow-ovate, glabrous, reddish-purple, about $\frac{3}{4}$in. long, exangular, shortly and obtusely pointed. In sandy soil.

449. *T.* Rogersii W.V.F., n. sp.

Arborescent and evergreen, the young shoots pubescent, otherwise glabrous; leaves alternate, oblong-lanceolate to oblanceolate, obtuse, tapering into the petioles, thinly coriaceous, very obliquely veined, much reticulate between, the midrib prominent beneath; spikes as long as the leaves; solitary, axillary, simple, glabrous, conspicuously pedunculate, flowers numerous but not crowded; calyx glabrous without, white-woolly within; the lobes obtuse; style and ovary glabrous; fruit globular, dark-purple, glabrous and smooth, exangular, almost or quite beakless.

Denham River (J. P. Rogers) (W.V.F.).

Height 30–40ft.; trunk to 12ft.; diameter 9in.; bark rough grey, tessellated; timber brown and tough; leaves 3–4in; flowers pale-yellow; calyx tube under $1\frac{1}{2}$ lines long; limb 2 lines diameter; stamens $1\frac{1}{2}$ lines long; fruits $\frac{3}{4}$in. diameter. On stony rises.

Affinities to *T.* erythrocarpa F. v M. and *T.* grandiflora Benth.

450. *T.* grandiflora Benth.

Isdell, Charnley, and Calder Rivers: Synnott Creek (W.V.F.).

A tree of 30–50ft.; trunk to 25ft.; diameter 1ft. or more; bark dark-grey, very thick, rough, and deeply longitudinally fissured; timber hard, free in the grain, dark brown in the inner half of the trunk, yellow without; leaves clustered at the ends of the branchlets; rachises and calyces closely invested with yellowish hairs; flowers yellow; fruits globular, purple, exangular. The plant is frequently almost entirely deciduous. The appearance and structure of the bark closely resembles that of *Eucalyptus* melanophloia F. v M. In sandy loams.

451. *Lumnitzera* racemosa Willd.

Cygnet Bay (W.V.F.)

A spreading shrub of 15ft. in height; flowers white to pale-yellow.

452. *Gyrocarpus* Jacquini Roxb.

A deciduous tree of 40ft.; trunk to 15ft.; diameter $1\frac{1}{2}$ft.; bark grey, smoothish; timber yellow, soft, and free. "Yellow-wood." In sandy loams.

MYRTACEÆ.

453. *Verticordia* Cunninghamii Schauer.

This tropical species varies from a tall shrub to a tree of 25ft. in height ; trunk to 8ft. ; diameter 7in. ; bark greyish, thin, fibrous, rough ; timber dark-brown to almost black and extremely hard ; flowers white to pale-yellow.

454. *V.* grandis Drum.

A shrub, 2ft. in height and spreading to a width of 3ft. ; flowers scarlet.

455. *Calythrix* microphylla A. Cunn.

A bushy shrub, 10 15ft. high ; flowers reddish-purple.

456. *C.* achæta F. v M.

Glenelg River (J. Martin) ; between Napier and King Leopold Ranges ; Lennard, Isdell, Barker, Adcock, Hann, Barnett, Charnley, Calder, Ord, Denham and King Rivers ; Dillen's Springs (W.V.F.).

A Selaginella-like shrub of 10ft. high or less ; flowers white. Among sandstone and quartzite rocks.

457. *C.* brachychæta F. v. M.

Between Lennard River and Inglis' Gap, King Leopold Ranges ; Isdell, Charnley, Denham and King Rivers (W.V.F.)

Diffuse, to 15ft. high ; glabrous excepting the flowers, which are white. In sandy soil.

458. *Melaleuca* alsophila A. Cunn.

Erect bushy shrub of 15ft. to a tree of 25ft. ; trunk to 6 or 8ft. ; diameter 9in. ; bark whitish to greyish, papery, and peeling off in sheets ; timber reddish, fairly hard and tough ; filaments pale yellow.

459. *M.* Crosslandiana W.V.F. n. sp.

Shrubby to arborescent, the young shoots, rachises, calyces silky pubescent, otherwise glabrous ; leaves alternate lanceolate, acute, firm, alternated into short petioles, 3–5 nerved, anastomosing between ; flowers in loose terminal spikes, often several together, the axis growing out into a leafy branchlet before or on completion of the flowering ; calyx-tube ovoid, the lobes very short, broad and obtuse ; petals pink, almost orbicular, on short broad claws, glabrous ; staminal claws much shorter than the petals, each with 4 -5 rather thick crimson filaments ; anthers sulphur-yellow, ovate ; ovary white-tomentose ; ovules exceeding numerous, somewhat ascending on a thickened placenta ; style exceeding the stamens, the stigma dilated, capitate, fruiting calyx ovate-truncate ; seeds wingless.

Base of Mt. House, near Derby. (W.V.F.).

A shrub of 8 -12ft. to a tree of 30ft. ; trunk to 12ft. ; diameter 1ft.; bark grey, rough, fibrous and persistent, timber

reddish-brown, hard and rather tough ; leaves $2\frac{1}{2}$-$3\frac{1}{2}$in. long ; spikes $2\frac{1}{2}$–4in. ; calyx nearly 2 lines long ; petals under $1\frac{1}{2}$ lines long ; filaments $\frac{3}{4}$in. ; fruiting calyx almost 2 lines long. In sandy flats.

Named in honor of Mr. Charles Crossland, who was in command of the 1905 Kimberley Exploring Expedition.

Affinity to *M.* leucadendron L.

460. *M.* leucadendron L.

A tree to 80ft. ; trunk to 40ft. ; diameter to $2\frac{1}{2}$ft. ; bark whitish to greyish, rather tough and decorticating in sheets ; timber red, tough, hard and durable ; stamens from white, greenish-yellowish to pink. The bark is used for roofing purposes, also by the aborigines in the manufacture of buckets, etc. The timber is utilised for building purposes. "Cajeput."

A form known as "Hill Cajeput" along the Lennard River, grown on sandy scrubby rises. It attains a height of 30ft., with very tortuous branches ; leaves very rigid and often more than 7-nerved, filaments greenish-yellow.

461. *M.* argentea W.V.F. n. sp.

Shrubby to arborescent, with a bushy crown, the branches often pendulous and, along with the leaves, rachises and calyces closely invested with a white silvery silky appressed tomentum ; leaves alternate, often vertical, lanceolate, acute, alternated at the base into a short petiole, of soft texture, usually 5-nerved, with anastomosing veins ; flowers closely packed in terminal interrupted spikes, of which several are sometimes together, the axis growing out into a leaf branchlet before the completion of the flowering ; calyx-tube broadly ovoid, the lobes much shorter, very broad and obtuse ; petals white, obovate glabrous ; staminal claws shorter than the petals, all somewhat connate in a ring at the base, each claw with seven white or pink filaments ; anthers ovate-oblong ; ovary pubescent ; ovules numerous, ascending on a thickened placenta ; style rather long ; fruiting-calyx hemispherical truncate ; seeds ellipsoid.

Isdell, Charnley, Fitzroy, Ord, Denham Rivers, etc. (W.V.F.).

Height to 45ft. ; trunk to 10ft. ; diameter 1ft. ; bark whitish, papery, and decorticating in sheets ; timber reddish-brown, hard and rough ; leaves 3–4in. long ; flowers emitting a sickly-sweet odour ; spikes $2\frac{1}{2}$–6in. long ; calyx $1\frac{1}{2}$ lines long ; petals 2 lines long ; filaments scarcely $\frac{1}{2}$in ; fruiting calyx $1\frac{1}{2}$ lines long.

Always in stony or sandy spots along or in the beds of watercourses.

Affinity to *M.* leucadendron L.

462. *M.* Loguei W.V.F. n. sp.

A much-branched erect shrub, the branchlets and young foliage sericeous, ultimately glabrous with age ; leaves alternate, frequently vertical, linear-lanceolate, acute, alternated at the bases, rigid but not thick, obscurely tri-nerved ; flowers not seen but apparently small, in a loose terminal spike, the axis growing out into a leafy branchlet, the rachis and calyces scantily pubescent ; fruiting-calyx hemispherical, truncate ; seeds numerous, not winged, cuneate.

South of the Fitzroy River (Mayo Logue).

Height about 8ft.; leaves ½ to nearly 1in. long ; spikes about 1in.; fruiting-calyx above 1 line diameter. In desert country, forming patches near aboriginal wells.

Affinity to *M.* lasiandra F. v. M.

463. *M.* genistifolia Smith.

Between Isdell and Precipice Ranges ; north base of Mt. Brennan ; Upper Barker River (W.V.F.).

Shrub, 10–15ft. high, and as much across ; filaments pale-yellow. In sandy loam.

464. *M.* minutifolia F. v. M.

Between Inglis' Gap and Lennard River ; Dillen's Springs, Ord, Denham, King Rivers, near Wyndham (W.V.F.).

A tree to 30ft. high ; trunk to 10ft. ; diameter 6–9in. ; bark persistent, dark-grey, thin, fibrous, rough ; timber reddish-brown, and hard ; filaments white. In sandy and stony soils.

465. *M.* dissitiflora F. v. M.

MacNamara Creek, Hann River (W.V.F.).

A tree of 25–30ft. ; trunk to 10ft. ; diameter 9in. ; bark rough, greyish, flaky ; timber reddish and fairly tough and hard ; filaments white. In sandy loam.

466. *Beaufortia* elegans Schauer.

Diffuse, 3–4ft. high ; filaments scarlet or purple.

467. *Tristania* suaveolens Smith.

Barker, Isdell, Hann, Charnley, Calder, Throssell, Fitzroy, and Ord Rivers ; MacNamara and Harris Creeks ; eastern base of Mt. Broome, near Wyndham (W.V.F.).

A tree of 50ft. ; with spreading branches ; trunk to 20ft. ; diameter 2ft. ; bark greyish, thin, scarcely rough ; timber reddish, very tough and moderately hard ; flowers pale. The " Fresh-water Mangrove " of North-West Australia. The species occurs in Papua.

Eucalyptus (see Introductory Note).

468. *E.* mooreana (W. V. Fitzgerald) Maiden, Proc. Roy. Soc. N.S.W. XLVII., 221 (1913).

469. *E.* confluens (W. V. Fitzgerald) Maiden, op. cit. XLIX., 317 (1915).

470. *E.* Houseana (W. V. Fitzgerald) Maiden, *loc.* cit. p. 318.

(A complete list of species of Eucalypts from North-West Australia will be compiled later.)

471. *Xanthostemon* paradoxus F. v. M.

A bushy-topped tree of 30–40ft. ; trunk to 15ft. ; diameter 1–1½ft. ; bark dark-grey, rugged but rather thin ; timber brownish, tough, and hard ; leaves to 5in. long ; stamens 1in. long, yellow ; fruits ovoid-globose, 4 5 lines diameter ; 3-celled.

472. *Fenzlia* phebalioides W.V.F. n. sp.

An erect shrub with numerous hardwood branches and, excepting the older branches and upper surface of the adult leaves, more or less invested with a close white tomentum ; leaves petiolate, oblong to narrow-oblanceolate, rounded at the apex, shortly tapering to the base, the margins flat or slightly revolute, thinly coriaceous, the venation congested, upper portion dull-green, and scarcely shining, glandular dots numerous and conspicuous, especially on the whitish under page ; flowers on slender pedicels, with two opposite subulate bracteoles a short distance between the calyx ; calyx-tube very shortly and broadly produced above the ovary, lobes subulate, acute, a'most as long as the tube ; petals orbicular, woolly-tomentose, 5-nerved ; filaments as long as the petals ; anthers small ; ovary 1-celled, two ovulate ; style comparatively stout, the lower half tomentose, as long as the filaments ; fruit globular, hard, glabrous, one occasionally two-celled and surrounded by the closely reflexed calyx-lobes.

Slopes of Table-top Mountain, near Synnot Range (W.V.F.).

Height 4–6ft. ; leaves mostly ½–1in. long, rarely more ; petioles ⅓–1 line long. Pedicels ½–1in. or less. Calyx 1½ lines long. Petals 1½ lines diameter, red. Filaments red ; anthers yellow. Style red. Fruit under 2 lines diameter, dark-purple. In sandy loam.

Affinity to *F.* obtusa Endl.

473. *Eugenia* grandis Wight.

Edkins Range, Sunday Island (W.V.F.).

A shady tree, 30–40ft. ; trunk 15ft. ; diameter 1ft. or more ; bark light-greyish or whitish, smooth to somewhat rugose ; timber reddish or brownish ; flowers white or pinkish ; ripe fruits white, globular to ovate, often above 2in. diameter ; of an agreeable acid flavour, eaten by aborigines and termed by those on Sunday Island "Illarrie." In sandy loams.

474. *E.* myrtifolia Sims.
Charnley River (W.V.F.).
Shrub to a tree of 25ft. ; trunk about 8ft. ; diameter 7in. ; bark grey, smooth ; timber reddish and moderately hard. In sandstone and quartzite gorges.

475. *E.* eucalyptoides F. v. M.
Isdell, Charnley, Calder, Ord, Denham, and King Rivers, Walcott Inlet (W.V.F.).
A bushy shrub to a tree of 25ft. ; trunk to 10ft. ; diameter 9in. ; bark grey, smooth ; timber brownish, hard and rather tough ; flowers pale-yellow ; fruits pink, globose, 4–5 lines diameter ; of a pleasant acid flavour. In sandstone and quartzite country along the banks of streams.

476. *E.* Armstrongii Benth.
Calder River, base of Packhorse Range, near Isdell River (W.V.F.).
A shrub of 20ft. in height. In sandy loam.

477. *Barringtonia* acutangulare Gaertner.
The North-Western plant is a diffuse or bushy shrub of 4–10ft. in height, with scarlet filaments and purplish quadrangular fruits. The bark is used by the aborigines for poisoning fish.

478. *Careya* australis F. v. M.
A tree of 25–30ft. ; trunk to 15ft. ; diameter about 1ft. ; bark dark-grey, rather rough and sometimes slightly furrowed ; timber reddish, very soft, and fibrous ; sepals greenish-white ; stamens white. The bark contains much tannin.

479. *Osbeckia* australiana Naudin.
Prince Regent's River (J. Bradshaw and Allen) ; West Kimberley (Dr. House) ; Isdell and Charnley Rivers, Dillen's Springs (W.V.F.).
Erect, 6–10ft. ; petals reddish-purple ; stamens yellow ; style pink, with a greenish stigma.

480. *Melastoma* malabathricum L.
Charnley River (W.V.F.).
Erect, 8–12ft. ; flowers reddish-purple.
In sandstone and quartzite gorges.

ÆNOTHERACEÆ (ONAGRACEÆ).

481. *Jussiaeua* suffruticosa L.
Ord River (Alex. Forrest) ; Lennard, May, Fitzroy, Hann, Isdell, Charnley, Calder, Ord, Denham and King Rivers (W.V.F.).
In sandy loams.

482. *Ludwigia* parviflora Roxb.
Pentecost River (J. Bradshaw and Allen) ; Isdell and Charnley Rivers (W.V.F.).
In black and sandy loams.

HALORRHAGACEÆ.

483. *Halorrhaghis* acanthocarpa Brongn.
Sources of Sturt Creek (F. v. M.) ; Mts. Brown and Herbert ; Bold Bluff ; north-east base of Precipice Range ; Isdell River ; Packhorse Range (W.V.F.).
Varying from weak and almost glabrous to robust and very hirsute. The specimens from the King Leopold Ranges are from diffuse plants, 1 2ft. high ; those from near Precipice Range, Bold Bluff and Isdell Rivers are of straggling habit, often intricate, and 1–2ft. high. The Packhorse Range plant has glabrous almost filiform stems and deeply serrated leaves which are under $\frac{1}{2}$in. long.
Growing in dry or moist sandy soils.

UMBELLIFLORÆ.

UMBELLIFERÆ.

484. *Trachymene* hemicarpa Benth.
King Leopold Ranges, Isdell, Charnley and Calder Rivers (W.V.F.).
Erect, 4–6in. ; flowers white.
Var. major Benth.
Erect, 2–4ft. ; flowers white to yellowish.

SYMPETALEÆ.

PRIMULALES.

MYRSINACEÆ.

485. *Ægiceras* majus Gaertner.
Cygnet Bay (W.V.F.).
A spreading shrub of 15ft. in height ; flowers white.
In saline boggy creeks.

PLUMBAGINALES.

PLUMBAGINEÆ.

486. *Statice* salicorniacea F. v. M.
Peron's Peninsula ; Freycinet Harbour ; Shark's Bay (F. v. M.) Nannine ; Port Hedland (W.V.F.)
Stems creeping and rooting . At Port Hedland the branches are erect, 6–9in. high ; at Nannine they are straggling or procumbent and 2 -3ft long. Flowers white.
In sandy saline spots.

487. *Plumbago* zeylanica L.
Wingrah Pass, Napier Range ; Barker and Isdell Rivers (W.V.F.)
A spreading shrub, 2-3ft. high ; flowers white.
In rocky spots.

EBENALES.

SAPOTACEÆ.

488. *Lucuma* sericeus Benth.
A spreading shrub of 15ft. in height

489. *Sideroxylon* arnhemicum Benth. et Hook.
Between Roe and Drysdale Rivers (J. Bradshaw and Allen) ; Isdell and Barker Rivers ; King Leopold, Lady Forrest, Packhorse, Isdell, Synnott, Artesian, Edkins, and Harding Ranges (W.V.F.).
A tree to 30ft. ; trunk 10-15ft. ; diameter 8-9in. ; bark grey, somewhat rugose ; timber pale and not very hard ; fruits globular or ovoid, succulent, yellowish, scantily tomentose, 1in. diameter, seeds 4, obovate-ellipsoid, ½in. long, the testa brown and shining.
Among sandstone and quartzite rocks.

490. *Mimusops* parvifolia R. Br.
Careening Bay (A. Cunn.) ; Swan Point and Cape Leveque (W.V.F.).
A tree of 40ft. ; trunk 20ft. ; diameter 1ft. ; bark greyish, smooth ; timber pale, not hard ; fruits globular, reddish, ½in. diameter ; seeds eaten by aborigines.
In sandy loam.

EBENACEÆ.

491. *Diospyros* montana Roxb.
Goose Hill, Ord and Denham Rivers ; Swan Point (W.V.F.).
A twiggy shrub of 6–8ft. in height and not spinescent ; flowers white to pale yellow ; fruits brown, sometimes above 1in. diameter. The *D.* cordifolia Roxb. of the Flora Australiensis.

492. *D.* nitens (W.V.F.).
A strong-growing bushy shrub, the branches and leaves glabrous, the young shoots silky-hairy ; leaves distinctly petiolate, ovate-oblong to broad-lanceolate, shortly acuminate or rounded at the apices, tapering at the base, thin but coriaceous, olive-green and shining above, dull-green beneath, the veins fine, ascending and reticulate between ; flowers not seen ; fruiting calyx solitary, sessile and surrounded at the base by a few small broad bracts, pube-

scent within and without, and forming an acutely edged sub-hemispherical cup at the base of the fruit, the lobes 4, rarely 5, broadly triangular, less than half the length of the tube, ascending; fruit 8-celled, each cell 1-seeded, globular, before maturity closely invested with appressed greyish or yellow hairs, which ultimately disappear except at the apex; seeds rugose, somewhat shining, the albumen horny.

Wingrah Pass, Napier Range, Sprigg and Charnley Rivers. (W.V.F.).

Height 8–10ft. Leaves to above 8in. long, 2–3in. broad; petioles $\frac{1}{4}$in. long. Fruiting-calyx attaining a diameter of above $\frac{1}{2}$in. Fruit $\frac{3}{4}$in. diameter, of a reddish colour, and very bitter to the taste. Seeds $\frac{1}{3}$in. long, 2 lines broad, brown.

In sandy or stony spots overlying sandstone, quartzite or limestone.

493. *Maba* humilis R. Br.

Hills near the junction of Hann and Barnett Rivers; Artesian and Edkins Ranges. (W.V.F.).

A tree of 20–25ft. with spreading branches; trunk to 10ft. diameter 1ft.; bark grey, smooth; timber pale, dense and hard.

Among sandstone and quartzite rocks.

CONTORTÆ.

OLEACEÆ.

494. *Jasminum* simplicifolium G. Forster.

Prince Regent's River (J. Bradshaw & Allen); Isdell, Charnley, Calder, Ord, Denham and King Rivers; Dillen's Springs (W.V.F.).

Stems erect, 3-5ft.; branches long and flexuose; fruits globular, 5 lines diameter, black. In sandy soil.

Var. molle Benth.

Near the entrance to King River (W.V.F.).

Erect, 1-3ft. In sandy loam.

LOGANIACEÆ.

495. *Strychnos* lucida R. Br.

An erect rigidly branched shrub, 8-12ft.; fruits orange-yellow; seeds extremely bitter. The pulp of the fruits is eaten by birds.

496. *Mitrasacme* lepidocalyx (W.V.F.), n. sp.

An erect, slender-stemmed annual, glabrous in every part, dichotomously branched from about the middle; leaves all radical and rosulate, oblanceolate, 1-nerved; bracts subtending the branches, branchlets and inflorescence in solitary pairs, connate or free, ovate, obtuse, flowers pedicellate, small, 4 or more together in simple umbels, the whole inflorescence forming a rather large dichotomous panicle, with 1-2 flowers in the forks; pedicels filiform; calyx-tube with 5 prominent dark-coloured ribs which terminate in extremely short broad obtuse lobes, the spaces between the ribs closely invested with small white scales; corolla slender, the lobes lanceolate, obtuse, scarcely as long as the tube; filaments inserted above the middle of the tube; anthers narrow-oblong, conspicuously exserted; style much exserted, with 2 rather short oblong linear stigmatic lobes; capsule shortly exceeding the calyx, ovoid-oblong, acute.

Messmate Creek, Packhorse Range (W.V.F.).

Height 6-12in. Leaves $\frac{1}{2}$-1in. long. Bracts $\frac{1}{4}$-$\frac{3}{4}$ line long. Calyx $\frac{1}{2}$-$\frac{3}{4}$ line long. Corolla $1\frac{1}{2}$-$1\frac{3}{4}$ line long, white. In wet sandy soil.

Affinity to *M. exserta* F. v M.

497. *M.* hispida (W.V.F.), n. sp.

An erect weak branching annual, the stems, branches and inflorescence hispid with short spreading white hairs; leaves on the lower portion of the stem, the radical ones withering before the flowering commences, the uppermost 2 pairs approximated so as to form a false whorl at the base of the branches, of thin texture, lanceolate-ovate, obtuse or slightly mucronate, trinerved, glabrous above, beneath the nerves alone hispid; bracts small, linear; flowers in simple or compound few-flowered umbels, often nodding on filiform pedicels; calyx-lobes deltoid, acute trinerved, as long as the tube; corolla campanulate, glabrous or scantily bearded within, the lobes very short; filaments inserted near the base of the tube; anthers ovate, usually semi-exserted; style soon separating at the base, shortly exserted, stigmatic lobes short, rather thick and slightly divaricate; capsule globular, scarcely exceeding the calyx, the persistent styles connivent in the upper portion.

Lennard and Isdell Rivers; Bell Creek; eastern base of Mt. Rason (W.V.F.).

Height 6-12in. Leaves usually under 1in. long. Calyx $\frac{3}{4}$-line or less in length. Corolla seldom above 3 lines long, yellow. In moist grassy spots.

Affinity to *M. lutea* F. v M.

498. *M. nudicaulis* Reinwardt.
Near Mt. Bartlett, Isdell River; eastern base of Mt. Rason (W.V.F.).
Leaves rosulate; corolla white. In moist grassy localities.

GENTIANACEÆ.

499. *Canscora* diffusa R. Br.
Bases of Bold Bluff and Precipice Range; Isdell River; Bell Creek (W.V.F.).
Flowers pink. In moist sandy soil.

500. *Limnanthemum* minimum F. v. M.
York Sound (A. Cunn); Isdell River (W.V.F.).
Stems sometimes matted, 6-12in. long; flowers white. Floating in water.

501. *L.* indicum Thwaites.
Lennard and Isdell Rivers (W.V.F.).
Flowers white, the petals fimbriated. Rooting in mud, the leaves floating in still water.

502. *L.* crenatum F. v. M.
Meda, May, Lennard, Isdell and Charnley Rivers; Bell Creek (W.V.F.).
Stems running many yards or rooting at each node in mud; leaves floating in still water; flowers yellow; petals fimbriated.

APOCYNACEÆ.

503. *Carissa* lanceolata R. Br.
A spreading intricately branched shrub of 4-8ft. in height; flowers white; fruits purple, ovate, about 2 lines long, somewhat succulent, and yielding a viscid white juice. An excellent hedge plant. Growing in sandy soils. The "Water Currant" of Kimberley.

504. *Alstonia* verticillosa F. v. M.
Montague Sound (A. Cunn.); Edkins Range; Charnley and Barker Rivers; vicinity of Napier Range (W.V.F.).
A bushy tree to 50ft. in height; trunk 20-25ft., diameter 2-2½ft.; bark dark-brown, almost black, thick, rough and corky; timber pale and not very hard; sap copious, milky. In sandy loam.

505. *Wrightia* saligna F. v. M.
A willow-like tree of 20-25ft.; trunk to 10ft.; diameter 6in.; bark grey, rough and longitudinally fissured; timber pale, and rather soft. This plant, which is more often a shrub,

grows in sandy scrubby country ("Pindan"). Stock will often stray for many miles for the purpose of feeding on the leaves. In Kimberley it is known as "Milk-bush," where it is regarded as the best top-feed plant.

506. *Parsonia* velutina R. Br.
Ord, Denham and King Rivers; Cygnet Bay; Wingrah Pass, Napier Range (W.V.F.).
In sandy soils.

ASCLEPIADACEÆ.

507. *Vincetoxicum* carnosum Benth.
Cygnet Bay (A. Cunn.), (W.V.F.).
Twining 2-4ft.; flowers yellow. In moist black saline soil.

508. *Cynanchum* floribundum R. Br.
Erect and 2-3ft.; or stems twining for many yards; leaves linear to linear-lanceolate, tapering towards or quite obtuse at the base.

509. *C.* pedunculatum R. Br.
Montague Sound (A. Cunn.); Pentecost River (J. Bradshaw & Allen), Isdell, Sprigg and Charnley Rivers (W.V.F.).
Stems prostrate for many yards or shortly twining; follicles purplish, 2½-3in. long, ¾-1in. broad, with two lateral wings; seeds ¼in. long. The follicles in outline resemble a dagger.

510. *Gymnema* sylvestre R. Br.
Wingrah Pass, Napier Range, Goose Hill, near Ord River; Denham River (W.V.F.).
Stems twining for many yards; flowers yellow. In sandy soil.

511. *G.* stenophyllum Asa Gray.
Roebuck Bay (J. W. O. Tepper); vicinity of Derby; Native Well; May, Barnett, Ord and King Rivers; Goose Hill (W.V.F.).
Stems erect, 2-3ft., numerous from a thickened stock; follicles 2-2½in. long, glabrous, not very thick, acuminate, with straight or curved apices.

512. *Tylophora* flexuosa R. Br.
Ashburton and Cane Rivers (Alex. Forrest); Meda, Lennard, Fitzroy, Barker, Isdell, Hann, Barnett, Adcock, Charnley, Calder, Ord, Denham and King Rivers (W.V.F.).
Twining to a considerable height, inflorescence usually paniculated and along with the calyces silky-hairy; corolla purple; follicles not very thick, glabrous, acuminate, 2-3½in. long.

513. *Marsdenia* cinerascens R. Br.
Stems twining for several yards; flowers white.

514. *M.* velutina R. Br.
Roebuck Bay (J. W. O. Tepper); Lennard, Isdell and Hann Rivers (W.V.F.).
Follicles glabrous or nearly so, from a broad base, acuminate, 2½in. long. In sandy soil.

515. *M.* viridiflora R. Br.
Grant Range (W.V.F.).
Stems twining many yards. Among sandstone boulders.

516. *M.* Broekmaniana (W.V.F.), n. sp.
A glabrous twiner, with slender stems and branches; leaves narrow-lanceolate to linear, obtuse or hardly acute, tapering into moderate petioles, sometimes scantily hirsute, veins very oblique, few but evident; flowers large, 2-3 together, pediculate on interpetiolar peduncles; calyx-segments narrow-ovate, obtuse; corolla rotate, lobed to about the middle, the lobes broad, obtuse, with ciliate margins, the lower portion of the tube with a densely tomentose, annular ridge within; corona-segments somewhat fleshy, with adnate saccate bases, the free erect portions linear with incurved tips and much exceeding the anthers; pollen-masses moderately large, oblong, erect; stigma compressed rather broad, shorter than the anthers; follicles obtuse, dagger-shaped when dry, rather large and glabrous when fresh; seeds obovate, scantily hirsute or glabrous, much compressed with narrow margins, conspicuously toothed at the apices.
Wingrah Pass, Napier Range; Upper Liverynga Station, Fitzroy River (W.V.F.).
Twining for many yards. Leaves 2-3in. long; petioles ⅓in. Flowers the largest of the genus. Peduncles 1-2in. Pedicels mostly about 1in. long. Calyx-segments 1½ line long. Corolla above ¾in. diameter; white, saturated with purple. Follicles 1½-2in. long, green, saturated with purple. Seeds above 1 line long, black.
In sandy soil. Readily distinguished by the comparatively small calyx and large corolla. The species is named in memory of the late Mr. F. S. Broekman, Surveyor General, Western Australia.

517. *Gymnanthera* nitida R. Br.
Beagle Bay (Alex. Forrest); Meda, May, Fitzroy, Lennard, Barker, Richenda, Isdell, Charnley, Calder, Sprigg, Ord, Denham and King Rivers; Bell and MacNamara Creeks; Walcott Inlet, Goose Hill (W.V.F.).
Twining to a great height. In moist sandy loam along the banks of water courses.

TUBIFLORÆ.

CONVOLVULACEÆ.

518. *Ipomaea* costata F. v. M.
Sherlock and Fortescue Rivers (J. Forrest); Lennard and Isdell Rivers; between Mt. Eliza and Inglis' Gap (W.V.F.).
Stems twining or rambling for many feet or the plant erect; bushy and 3-10ft. in height. In sandy loam.

519. *I.* reptans Poiret.
Gascoyne River (J. Forrest); May and Meda Rivers; in a billabong near Meda Station (W.V.F.).
Stems hollow, prostrate for several feet; flowers small, white. In black muddy spots. Includes *I. aquatica* Forskael.

520. *I.* diversifolia R. Br.
Roebuck Bay (J. W. O. Tepper); Meda, Lennard, and Fitzroy Rivers; near Derby (W.V.F.).
In sandy loam.

521. *I.* eriocarpa R. Br.
Roebuck Bay (J. W. O. Tepper); Meda, May, Lennard, Fitzroy, Isdell and Adcock Rivers (W.V.F.).
Seeds punctate. In sandy soil.

522. *I.* flava F. v M.
De Grey River (Ridley's Expedition); Calder River, near Walcott Inlet; King River near Cambridge Gulf (W.V.F.).
Stems trailing or twining for many yards; flowers sulphur-yellow. The specimens referred to in the Flora Australiensis as having been collected by Ridley's Expedition in all probability do not belong to this species.

523. *I.* turpethum R. Br.
Port Hedland (W.V.F.).
Stems twining for several feet; flowers white. In sandy soil.

524. *I.* plebeia R. Br.
Adcock, Isdell, Hann and Barnett Rivers (W.V.F.).
Flowers white. In stony and sandy spots.

525. *Polymeria* ambigua R. Br.
Meda, Lennard, Isdell and Fitzroy Rivers; near Derby (W.V.F.).
In sandy loam.

526. *P.* angustata F. v M.
Roebuck Bay (J. W. O. Tepper); May, Meda, Lennard and Fitzroy Rivers (W.V.F.).
In sandy spots.

527. *P.* distigma Benth.
Glenelg River (J. Martin); Isdell River; Bell Creek (W.V.F.).
Stems simple or slightly branched, 1-2ft. high; several erect together from the one stock; flowers purple or pale-blue. On grassy flats.

528. *Brewcria* media R. Br.
King Sound District (Froggatt); near Derby; Goody Goody; Native Well; Meda, Lennard, Isdell, Fitzroy and Barker Rivers (W.V.F.).
Stems ascending from a thickened stock and along with the leaves silky-hirsute; flowers bright blue. In light sandy soil.

529. *B.* pannosa R. Br.
Mt. Marmion, Lennard River; Ord, Denham and King Rivers (W.V.F.).
Stems prostrate, often several yards long; leaves ovate sericeous; flowers blue. In ferruginous gravels.

530. *B.* rosea R. Br.
Erect, 1-2ft.; flowers nodding, pink to almost white.

HYDROPHYLLACEÆ.

531. *Hydrolea* zeylanica Vahl.
King Sound District (Froggatt); Lennard, Fitzroy, Barker and Isdell Rivers (W.V.F.). Not very common.

BORRAGINEÆ.

532. *Ehretia* saligna R. Br.
A willow-like tree to 30ft. in height; trunk 8-10ft.; diameter 6in.; bark greyish, smooth; timber pale and fairly hard; flowers white or pale-yellow; fruits scarlet.

533. *Ehretia* urceolata (W.V.F.), n. sp.
Deciduous; shrubby to arborescent, glabrous, the branchlets rather stout; leaves broad to narrow-linear, fine pointed but scarcely acute, tapering into conspicuous petioles, entire, very obliquely veined; flowers in sub-axillary, repeatedly dichotomous pedunculate cymes, which are incurved when in fruit and always shorter than the leaves; calyx lobed to the middle, the lobes ovate, obtuse, glabrous or scantily ciliolate; corolla-tube urceolate and very thin, the lobes reflexed, obtuse, as long as the tube; filaments rather broad; anthers included, or the tips exserted, as long as the filaments; ovary two-celled with two ovules in each cell; style bifurcated halfway down, the entire part included,

the lobes exserted and divaricate, stigmas truncate; fruit ovoid, obtuse, indistinctly four-ribbed, usually consisting of four one-seeded not very hard pyrenes.

Mt. Marmion (W.V.F.).

Height to 40ft.; trunk 10ft., diameter 9-12in. Bark greyish, smooth. Timber pale-yellow and moderately hard. Leaves 3-5in. long, thin, bright-green. Calyx ½ line long. Corolla 2 lines long, yellow, Fruit 1½ line diameter, scarlet. In iron-stone gravel.

Affinity to *E.* saligna R. Br.

534. *Tournefortia* mollis F. v M.

Montague Sound (A. Cunn.); Goose Hill, near Ord River (W.V.F.).

An erect shrub, 8ft. high; flowers and fruits white.

535. *Coldenia* procumbens L.

Ord and King Rivers (W.V.F.).

In moist sandy spots.

536. *Heliotropium* ovalifolium Forskael.

A perennial with a thick woody stock; stems diffuse or spreading and attaining a height or length of 1ft.; the whole often as much across; flowers white. The species is always bracteate in North West Australia and not ebracteate as described in the Flora Australiensis.

537. *H.* flaviflorum (W.V.F.), n. sp.

A slender erect much-branched shrubby plant, glabrous excepting the flowers; leaves shortly petiolate, linear, subacute or acute, the margins entire and closely refracted; flowers distant in one-sided simple or once-forked racemes terminating the branchlets; bracts setaceous and deciduous, occasionally none; calyx moderate, the outer segments ovate, the inner much narrower, all acute and ciliolate; corolla yellow, scantily invested without with closely appressed scabrid hairs, the tube ventricose about the middle and densely barbellate within, nearly twice as long as the calyx, lobes narrow-ovate, obtuse, a little more than half as long as the tube; anthers acuminate, cohering by their tips; style comparatively stout, at least four times as long as the obscurely four-lobed stigma; central cone small and obtuse; fruit almost mitriform, crowned by the persistent base of the style, the nuts, four, glabrous and shining.

Packhorse Range; Mt. Rason; near Mt. Marmion (W.V.F.).

Height 2-3ft. Leaves 1in. or less in length. Calyx 1 line long. Corolla under 2 lines long. Fruit ¾ line diameter. Seeds almost black. In dry sandy soil.

Affinity to *H.* paniculatum R. Br.

538. *H.* strigosum Willd.

Cygnet Bay (A. Cunn.); Denham and King Rivers; Sunday Island (W.V.F.).

Stems erect, 6-9in.; flowers white. Among sandstone and quartzite rocks.

539. *H.* conocarpum F. v M.

Isdell and Adcock Rivers (W.V.F.).

Diffuse, 1-1½ft. high; flowers white; fruit ripening 2-4 nuts. In sandy loam.

540. *H.* diversifolium F. v. M.

Cygnet Bay (A. Cunn.); Derby, Goody Goody, Cygnet Bay (W.V.F.).

In sandy spots.

541. *H.* ventricosum R. Br.

May, Meda, Lennard and Isdell Rivers (W.V.F.).

A form with slender wiry straggling almost woolly stems and branches, which attain a total length of 1ft.; spikes slender, interrupted; calyx-segments 1 line long, the outer ovate, the inner narrower, all acute; corolla white, 4 lines long.

In grassy spots.

542. *Trichodesma* zeylanicum R. Br.

Semi-herbaceous, 3-5ft. high; calyx green; corolla white or blue. In sandy soil.

543. *T.* indicum R. Br.

Adcock River, near Mt. House (W.V.F.).

Stems erect, 2-4ft.; flowers blue. In stony localities.

VERBENACEÆ.

544. *Cyanostegia* Bunnyana F. v M.

Roebuck Bay (J. Martin); Frant Range (W.V.F.), south of the Fitzroy River (Mayo Logue).

A spreading shrub of 3-4ft. in height and at least as much across; flowers bright blue. In sandy soil.

545. *Clerodendron* tomentosum R. Br.

Roebuck Bay (J. W. O. Tepper); Broome; Packhorse Range; Lennard River; Dillen's Springs (W.V.F.).

A tree, 25-30ft.; trunk 8-10ft.; diameter 1ft.; bark greyish and slightly rugose; timber pale and rather soft; flowers white. In sandy soil.

546. *Callicarpa* cana L.
King Sound District (Froggatt); Meda, May, Lennard and Isdell Rivers (W.V.F.).
A diffuse weak-growing shrub, 4-8ft. in height; flowers white; fruits black. In sandy soil alongside of water-courses.

547. *Premna* acuminata R. Br.
A bushy tree of 25ft.; trunk to 10ft.; diameter 10in.; bark greyish and slightly rough; timber pale and rather soft; flowers whitish; fruits black.

548. *P.* integrifolia L.
Roebuck Bay (J. W. O. Tepper); Broome; near Derby; May and Isdell Rivers (W.V.F.).
A tree 15-20ft.; trunk to 6ft.; diameter 6in.; bark light-grey, smooth or scarcely rough; timber yellowish and fairly soft.

549. *Vitex* glabrata R. Br.
A tree of 25-30ft. with a bushy crown; trunk 12ft.; diameter to 1ft.; bark grey, smooth; timber pale, dense, and fairly hard; flowers white.

550. *Avicennia* officinalis L.
A tree of 25-30ft.; trunk to 10ft.; diameter 1ft.; bark whitish to yellowish and fairly smooth.

LABIATÆ.

551. *Moschosma* polystachya Benth.
Lennard, Barker, Fitzroy, Charnley, Isdell, Calder, Ord and Denham Rivers (W.V.F.).
A strongly scented plant, erect, 2-4ft.; flowers white. In moist black or sandy loam.

552. *Coleus* scutellarioides Benth.
Isdell, Charnley, Sprigg and Calder Rivers; Dillen's Springs (W.V.F.).
A strongly scented erect shrub of 3-4ft.; flowers blue. In wet black soil.

553. *Plectranthus* congestus Benth.
Near the source of the Isdell River (W.V.F.).
An erect strong smelling herb of 3-4ft. In rock crevices.

554. *Dysophylla* verticillata Benth.
Isdell, Charnley and Calder Rivers and adjacent springs; base of Mt. Rason (M.V.F.).
Stems erect to 1ft.; leaves often toothed; flowers pink. In still water or wet soil.

SOLANACEÆ.

555. *Solanum* pubescens Willd.

Goody Goody, nine miles from Derby (W.V.F.).

A spreading shrub, 3ft. in height. In moist sandy soil.

Although there is a possibility of this Asiatic species having been introduced, the specimens differ from typic ones by having a much larger calyx and constantly white flowers.

556. *S.* ellipticum R. Br. var. pannifolium A. Cunn.

N.W. Coast; Cambridge Gulf (A. Cunn.); Wyndham; Goose Hill, near Ord River (W.V.F.).

Among sandstone and quartzite rocks.

557. *S.* quadriloculatum F. v M.

Roebuck Bay (J. W. O. Tepper); Lennard, Isdell, Barnett, Hann, Charnley and Calder Rivers; Mt. Herbert; Station Creek (W.V.F.).

Erect or diffuse, 2-3ft. high; flowers bluish-purple; fruits yellow. Some specimens appear to differ, although all have a four-celled ovary; the flowers are differently disposed, the males in lateral racemes, the females solitary; axillary and on a different branch of the same plant; the fruiting calyces appear to assume three forms. In sandy soil.

558. *S.* cataphractum A. Cunn.

An erect, much-branched shrub, 3-4ft. high; calyces 4-4½ lines long when in flower, much enlarged in fruit, lobed to below the middle, the lobes narrow-ovate and ending in acuminated leafy tips; corollas purple, 2/3in. across, lobed to one-third of its width, the lobes broad, obtuse; anthers narrow-oblong, 2½ lines long, obtuse, on short filiform filaments; fruits 6-7 lines diameter; yellow when ripe. The diagnosis published in the Flora Australiensis was based on fruiting specimens only. When in flower the branches are stellate-tomentose, the tomentum disappearing as the fruiting advances.

559. *S.* echinatum R. Br.

Diffuse, 2ft. high; flowers to ¾in. in diameter; fruiting-calyx densely prickly; fruits completely four-celled.

560. *S.* Cunninghamii Benth.

Diffuse, to 3ft. high.

561. *S.* Cunninghamii (W.V.F.), n. sp.

An erect or spreading shrub, the branches, foliage, and inflorescence closely invested with a yellowish or reddish stellate tomentum; prickles slender on the stems and branches, few or absent from the leaves and male calyces, numerous on

those of the female flowers; leaves petiolate, broad-linear to narrow-lanceolate, obtuse or subacute, obliquely tapering at the base, the margins entire, soft and greenish on both sides; flowers dioecious; males in lateral pedunculate racemes, the pedicels as long as the calyx; calyx cupular, the teeth broad and short; corolla hirsute without, broadly and shallowly lobed; anthers on very short filaments, ovate-oblong; ovary rudimentary; female flowers solitary or thick, lateral pedicels, which are erect at first but become reflexed as the fruiting advances; calyx tube campanulate, the lobes linear and shorter than the tube, ultimately becoming membraneous, very prickly and enveloping the fruit; corolla as in the male flowers but much larger; anthers abortive; ovary two-celled; stigma large and oblong; ripe fruits not seen.

Dillen's Springs (W.V.F.).

Height 1-2ft. Leaves mostly 2-2½in. long, the petioles about ½in. Flowers bluish. Males: peduncles 1in. or more. Pedicels 2 lines. Calyx 2 lines long. Corolla scarcely ½in. diameter. Anthers 1 line long. Females: Pedicels ½-1in. Calyx ½in. long, and subsequently enlarging. Corolla almost 1in. diameter.

Among quartzite rocks and often in their crevices.

Affinity to *S. echinatum* R. Br.

562. *S.* phlomoides A. Cunn.

Diffuse, to 2ft. high. A pest along the Fitzroy River.

SCROPHULARIACEÆ.

563. *Stemodia* flaccida W.F.V., n. sp.

A strongly scented scarcely branched flaccid perennial, more or less invested with a short white glandular pubescence; leaves opposite, membranous, the lower ones ovate, obtuse, on long petioles, with stem-clasping auricles, coarsely toothed, the upper bracteate ones gradually smaller, ovate-lanceolate, serrate, amplexicaul and distant; flowers on slender axillary pedicels which frequently exceed the upper bracts, bi-bracteolate; calyx, the upper lip broad, entire or almost so, the lower with three broadly ovate, retuse or emarginate lobes, scantily hirsute without, the throat within densely hairy, anthers bilocular; capsule acuminate, rather narrow, two-thirds as long as the calyx.

Wingrah Pass, Napier Range (W.V.F.).

Height 1-2ft. Leaf laminae, 2-3in. long or less. Pedicels ½-1in. Calyx at least 3 lines long. Corolla ½in. long. Violet. In the crevices of limestone rocks.

Affinity to *S.* debilis Benth.

564. *Morgania* floribunda Benth.
Gascoyne River (J. Forrest and Polak); Carnarvon (W.V.F.).
In sandy spots.

565. *M.* pubescens R. Br.
Isdell River (W.V.F.).
Stems simple or few-branched, procumbent or ascending from a perennial stock, 1-2ft. long, the whole plant invested with a white woolly pubescence; leaves opposite or in whorls of three, obovate or cuneate, obtuse, narrowed below the middle, coarsely toothed above, broadly sessile; flowers wholly pedicellate in the upper axils; calyx 3 lines long, divided to the base into linear acute equal segments; corolla purple, at least one-third longer than the calyx, scantily tomentose without and within, the tube broad; lips broad, the upper one entire and as long as the tube, the lower lip as long with three obovate, obtuse lobes; filaments compressed; capsule glabrous, acuminate, much shorter than the calyx. In grassy spots. At first sight the plant reminds one of a species of *Chloanthes*. A description was not published by Bentham in the Flora Australiensis.

566. *M.* parviflora Benth.
Meda, Lennard, Isdell, Barnett, Charnley, Calder and King Rivers; Dillen's Springs (W.V.F.).
Ascending or straggling in habit; leaves entire or toothed, sometimes 1-1¾in. long; flowers purple. In sandy loam.

567. *Lindernia* subulata R. Br.
Base of Bold Bluff (W.V.F.).
Flowers bluish. In moist grassy spots.

568. *Limnophila* serrata Gaudich.
Isdell, Charnley and King Rivers; base of Mt. Rason (W.V.F).
Flowers reddish-purple. In shallow pools and wet black soil.

569. *L.* gratioloides R. Br.
Isdell, Charnley and Calder Rivers; one mile from north base of Bold Bluff; east base of Mt. Rason (W.V.F.).
Of Gratiola-like habit; flowers purple. In wet spots.

570. *Herpestis* floribunda R. Br.
Fitzroy River and Margaret Creek (Calvert's Expedition); Lennard River; Wingrah Pass; Napier Range (W.V.F.).
In wet sandy places.

571. *Ilysanthes* lobelioides Benth.
Base of Bold Bluff; Isdell River (W.V.F.).
Almost flaccid, much branched, usually 9-15in. high; lower leaves ½-¾in. long; flowers bluish-purple. In wet grassy spots.

572. *Microcarpaea* muscosa R. Br.
Wingrah Pass, Napier Range; Lennard, Isdell, Sprigg and Charnley Rivers; Synnott Creek (W.V.F.).
Stems prostrate and forming large patches on mud; flowers pink.

573. *Peplidium* Muelleri Benth.
Gascoyne and Sherlock Rivers (J. Forrest); Nannine (W.V.F.).
In gravelly or sandy spots.

574. *Glossostigma* spathulata Arnott.
Lennard, Isdell and King Rivers (W.V.F.).
Flowers pale-blue. In mud.

575. *Hemiarrhena* plantaginea Benth.
Mt. King, Glenelg River (J. Martin); Isdell and Charnley Rivers (W.V.F.).
Stems erect, several from a thick stock; flowers blue. In moist grassy spots.

576. *Striga* curvifolia Benth.
North-West coast (Bynoe), Broome (W.V.F.).
In sandy localities.

577. *S.* multiflora Benth.
Camden Harbour (J. Martin); Lennard River; Carpenter's Gap, Napier Range (W.V.F.).
In pebbly and sandy spots.

578. *Buchnera* multiflora Benth.
Napier Range; Lennard, Isdell, Charnley and Calder Rivers (W.V.F.).
In sandy soil.

579. *B.* ramosissima R. Br.
York Sound (A. Cunn.); Lennard, Isdell and Calder Rivers; Carpenter's Gap, Napier Range (W.V.F.).
In stony soil.

BIGNONIACEÆ.

580. *Dolichandrone* heterophylla R. Br.
A tree, 20-30ft.; trunk to 10ft.; diameter to 1ft.; bark grey, lamellated, often almost corky; timber pale and soft. The foliage is readily eaten by stock.

581. *D.* filiformis Fenzl.
King River (W.V.F.).
From a shrub to a tree of 25ft.; trunk to 8ft.; diameter 6in.; bark grey, tessellated; timber pale and somewhat soft; leaves simple, slightly viscid; flowers white to pale-yellow, odorous. The leaves are greedily eaten by stock. On sandy flats.

PEDALINEÆ.

582. *Josephinia* papillosa W.V.F., n. sp.

A spreading much-branched shrub, the branches scantily invested with very short crisped white hairs intermixed with white papillae; lower leaves petiolate, trilobed, scantily hirsute above, beneath silvery from the presence of densely crowded papillae intermixed with a few short hairs; lobes lanceolate to oblong, obtuse, coarsely toothed, often almost lobed, the central one much larger than the others, the upper floral leaves coarsely toothed or entire; pedicels from as long to twice as long as the calyx; calyx-segments lanceolate, obtuse or sub-acute, along with the pedicels papillose and pubescent without, glabrous within; corolla papillose and pubescent on both sides, the tube very broad, the lobes much shorter, the upper four broad and short, the lowest twice as long; ovary four-celled, style long, with two thickened stigmatic lobes; fruit globose, very prickly, papillose and white hirsute, the apex truncate.

Lennard River, 10 miles above its junction with the Barker River (W.V.F.).

Height, 1½-3ft. Leaves 1½in. long or less, the petioles ½in. or more. Pedicles 1½-3 lines. Calyx about 1½ lines long. Corolla 4½-5 lines long, pale-pink with a purple-spotted throat. Fruit, including the prickles, above 4 lines in diameter. Seeds pale brown. In sandy or strong soil.

Affinity to J. Eugeniae F. v M.

LENTIBULARINEÆ.

583. *Utricularia* charnleyensis W.V.F., n. sp.

Scapes bracteolate, glabrous, slender but rigid, erect, simple leaves radical, few (or sometimes none at the flowering period) spathulate, very small, on long petioles; bracts alternate, so much produced at the point of insertion as to appear peltate, rather narrow and acute at both ends; bracteoles 1-2, similar to the bracts; flowers small, subcapitate or in an interrupted spicate raceme, on bracteolate pedicels much shorter than the calyx; calyx-lobes almost orbicular, minutely denticulate, slightly enlarged in fruit; upper lip of the corolla narrow-ovate, entire and rounded at the apex, the margins incurved, slightly exceeding the calyx; lower tip ovate, entire, scarcely longer than the upper one, the margins rolled inwards; spur horizontal, obtuse, comparatively stout and projecting 1 line beyond the end of the lower lip; capsule globular.

Charnley River, lat. 16° 17′ (W.V.F.).

Height 4-9in., the whole plant drying black. Bracts at least 1 line long. Inflorescence 2in. long or less. Calyx-lobes 1 line long. Corolla blue. Capsule 1½ line long. In wet sandy spots.
Affinity to *U.* Baueri R. Br.

584. *U.* cyanea R. Br.
Charnley River, lat. 16° 17′ (W.V.F.).
Flowers pale-blue or purplish.
Associated with *U.* charnleyensis (W.V.F.).

ACANTHACEÆ.

585. *Ebermaiera* glauca Nees.
May, Meda, Lennard, Barker, Fitzroy, Isdell, Hann, Charnley, Calder and Denham Rivers (W.V.F.).
Leaves often ovate; flowers purplish streaked with yellow. In damp sandy soil.

586. *Hygrophila* salicifolia Nees.
North-West Coast (A. Cunn.); Meda, May, Lennard, Fitzroy, Isdell, Charnley and Calder Rivers (W.V.F.).
In muddy spots.

587. *Justicia* diffusa Willd.
Wingrah Pass, Napier Range; Bold Bluff (W.V.F.).
Corolla pale, spotted with purple. In crevices of rocks.
The specimens belong to the variety Vahlii Clarke (J. Vahlii Roth.).

588. *Hypoestes* floribunda R. Br., var. paniculata Benth.
Cape Upstart (Bynoe); Lennard River and Wingrah Pass, Napier Range (W.V.F.).
Among limestone rocks.

589. *Nelsonia* campestris R. Br.
Beagle Bay (Alex. Forrest); Native Well; May, Meda, Lennard, Barker, Fitzroy and Isdell Rivers (W.V.F.).
Prostrate or stems slightly ascending, often covering 2ft. of ground; flowers white. In dry sandy spots.

590. *Dicliptera* glabra Dene.
A small herb with an inflated calyx and white corolla.

MYOPORACEÆ.

591. *Pityrodia* obliqua W.V.F., n. sp.
An erect shrub, the branches white with a dense wool which often becomes yellowish upwards; leaves opposite, conspicuously petiolate, ovate-lanceolate to oblong-rounded at

the apices, more or less oblique and cordate, or rounded at the base, flat, thin, crenulated, tomentose green and rugose above, hoary-tomentose beneath, the venation evident; inflorescence cymose in the upper axils, woolly-tomentose, rarely exceeding the leaves, and forming a narrow leafy panicle; bracts linear; calyx divided almost or quite to the base into linear obtuse one-nerved lobes; corolla-tube broad, about as long as the calyx, the lowest lobe broader and slightly longer than the others, the whole tomentose; anthers slightly exserted, with small appendages to both cells; ovary densely tomentose for two-thirds of its length, then glabrous to the base; ovules attached near the top with short funicles; style slender, tomentose to shortly above the base, then glabrous; nut ovoid-globular, 2-3 of the carpels usually abortive.

Dillen's Springs (W.V.F.).

Height 2-4ft. Leaves 2-2½in. long, the petioles ½-¾in. Primary peduncles ½in. or less, the secondary and pedicels less. Bracts 2 lines or less. Calyx 3½ lines long. Corolla 4½ lines long, the lobes 1 line long and broad, pink with purple streaks in the throat. Nut 1 line long, black. In the clefts of quartzite and sandstone.

Affinity to *P.* paniculata F. v M.

592. *Eremophila* bignoniaeflora F. v M.

Yeeda and Fitzroy Rivers (W.V.F.).

Shrubby or arborescent, from 10-20ft. high; trunk to 5ft.; diameter 6in.; bark grey and often slightly rough; timber pale-yellow, not very hard and with a sandalwood odour; flowers white spotted with purple. Among ironstone gravel and sands. A "Sandalwood."

593. *E.* Willsii F. v M.

A bushy shrub of 1-3ft. high; flowers violet.

RUBIALES.

RUBIACEÆ.

594. *Sarcocephalus* cordatus Miquel.

Glenelg River (J. Martin); May, Meda, Lennard, Barker, Yeeda, Fitzroy, Richenda, Traine, Hann, Adcock, Isdell, Charnley, Calder, Ord, Denham and King Rivers; Bell, MacNamara, Harris and Synnott Creeks; Dillen's Springs (W.V.F.).

A shady tree of 40-50ft.; trunk 25ft.; diameter 1-1½ft.; bark dark-grey, smooth to rather rough; timber pale-yellow or brownish, straight-grained and bitter tasting. "Leichhardt Pine." In sandy loams on the banks of streams and springs.

595. *Dentella* repens Forster.
Yale and Sherlock Rivers (J. Forrest); May, Lennard, Fitzroy, Ord, Denham and King Rivers (W.V.F.).
Prostrate, and forming patches of several inches across in wet black soil or spreading over rocks to 1-2ft. in diameter; flowers white to pink, the petals most frequently not toothed; style lobes rather short.

596. *Oldenlandia* (*Heydyotis*) tillaeacea.
Isdell River (W.V.F.).
In damp spots.

597. *O.* trachymenioides F. v M.
Roebuck Bay (J. W. O. Tepper); near Derby (W.V.F.).
In sandy localities.

598. *O.* scleranthoides F. v M.
Meda, Lennard and Isdell Rivers (W.V.F.).
Flowers white. In damp soil.

599. *Gardenia* edulis F. v M.
Ord, Denham and King Rivers; Dillen's Springs (W.V.F.).
A tree of 25ft.; trunk to 10ft.; diameter 8in.; bark greyish, smooth or slightly rugose; timber pale-yellow and not very hard; leaves 1-1¾in. long; pedicels to 3 lines long; flowers white, sweetly scented, the tube about ½in. long; fruits almost 2in. diameter. In sandy loam.

600. *G.* pyriformis A. Cunn.
York Sound (A. Cunn.); Dillen's Springs; Goose Hill; Ord, Denham and King Rivers (W.V.F.).
A tree of 30-40ft.; trunk to 20ft.; diameter 9in.; bark greyish or brownish, rough or nearly smooth; timber pale-coloured; moderately hard and rather close-grained; flowers white, sweetly scented; fruits sometimes above 2in. long. In sandy loam.

601. *G.* megasperma F. v M.
Cambridge Gulf; Vansittart Bay (A. Cunn.); near Wyndham (W.V.F.).
Tree, 15-30ft.; trunk to 10ft.; diameter 1ft.; branchlets stout, the shoots and buds copiously viscid; bark grey, slightly rugose; timber pale, very brittle; leaves often tapering into the petioles, shining on both pages, to 8in. long by 5in. broad; fruits prominently 5-6 angled. Among quartzite rocks.

602. *G.* resinosa F. v M.
Dillen's Springs (W.V.F.).
A tree to 25ft.; trunk to 5ft.; diameter 6in.; bark grey and rather smooth; timber pale, not very hard. In sandy loam.

603. *G.* Keartlandi Tate.
Fitzroy River (Calvert's Expedition); Isdell, Hann Rivers; Sunday Island (W.V.F.).
Tree of 15-20ft.; trunk to 10ft.; diameter 8in.; bark grey, roughish; timber pale-coloured, rather hard. In sandy soil.

604. *G.* Pantoni F. v M.
Roebuck Bay (J. W. O. Tepper); Broome (W.V.F.).
A tree 20-30ft.; trunk to 12ft.; diameter 9in.; bark greyish to brownish, rough to almost smooth; timber pale, and moderately hard. In sandy loam.

605. *Randia* densiflora Benth.
Near junction of Hann and Barnett Rivers; Edkin's Range (W.V.F.).
A diffuse shrub 10-15ft. in height; fruits scarlet, globular, 3-4 lines diameter. In sandy soil.

606. *Timonius* Rumphii DC.
Careening Bay (A. Cunn.); Fitzroy, Isdell, Charnley and Calder Rivers; Endilla Springs; Grant Range; Sunday Island (W.V.F.).
A tree of 50ft.; trunk 25ft.; diameter 1-1½ft.; bark white or greyish, smooth or somewhat rough; timber pale-coloured and not very hard; flowers white, dioecious. In moist sandy soil.

607. *Ixora* tomentosa Roxb.
A shrub of 6ft. to a tree of 25ft.; apparently deciduous; trunk not exceeding 6ft.; diameter 6-7in.; bark grey, somewhat rugose; timber pale-coloured and rather soft.

608. *Canthium* attenuatum R. Br.
Brunswick Bay (A. Cunn.); Isdell, Charnley, Calder, Denham and King Rivers; Dillen's Springs (W.V.F.).
A shrub to a tree of 30ft.; trunk about 10ft.; diameter 9in.; branches pendulous; bark dark-coloured, rough; timber yellowish and close-grained; flowers numerous, white, sweetly scented; fruits greenish-black, wrinkled, didymous. In stony soil, most frequently on low rises.

609. *Morinda* citrifolia L.
Sunday Island (W.V.F.).
A tree to 25ft.; trunk 6-10ft.; diameter 9in.; bark grey, smooth; timber pale-coloured and not very hard; flowers and fruits white. In wet black or sandy loam.

610. *Spermacoce* pogostoma Benth.
Roebuck Bay (J. W. O. Tepper); near Derby (W.V.F.).
Flowers bluish. In sandy soil.

611. *S.* laevigata Benth.
Near Derby (W.V.F.).
Flowers bluish-purple. In sandy loam.
Var. hispida Benth.
Goody Goody, nine miles from Derby (W.V.F.).
Flowers bluish-purple. In sandy soil.

612. S. auriculata F. v. M.
Isdell, Charnley and Calder Rivers; Swan Point (W.V.F.).
Flowers purple to white. In sandy loams.

613. *S.* brachystoma R. Br.
Lennard, Isdell, Charnley and Calder Rivers (W.V.F.).
Flowers white. In sandy soils.

CUCURBITALES.

CUCURBITACEÆ.

614. *Luffa* graveolens Roxb.
Stems twining many yards; flowers yellow; fruits striped white and green, ultimately reddish.

615. *Cucumis* trigonus Roxb.
Stems twining many feet; flowers yellow; fruits white when ripe.

616. *Mukia* scabrella Arnott.
Twining for many feet; leaves usually hastate.

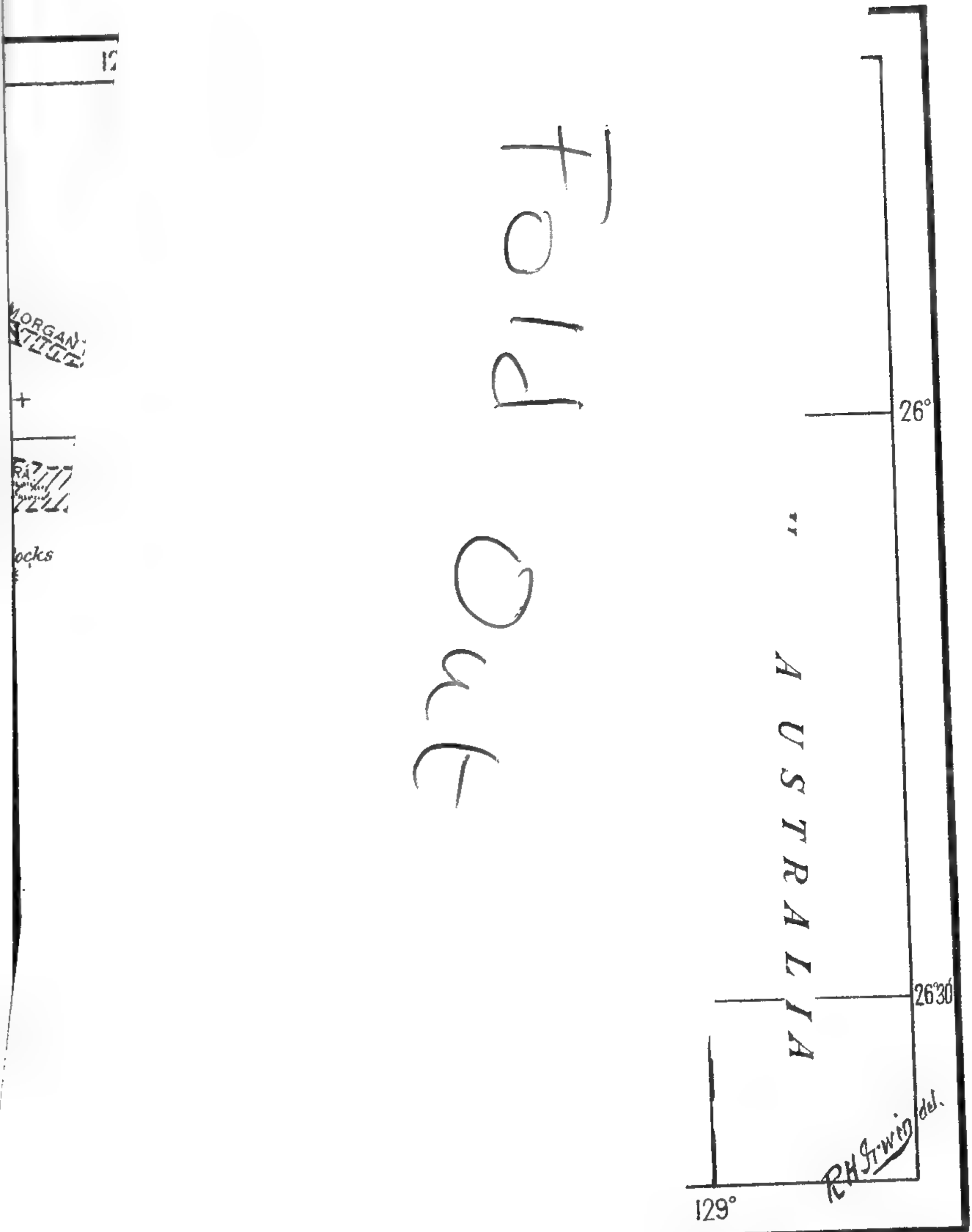
617. *Bryonia* laciniosa L.
Wingrah Pass, Napier Range (W.V.F.).
Fruits purple when ripe and of a nauseous taste.

618. *Melothria* Muelleri Benth.
King and Denham Rivers (W.V.F.).
In sandy loams.

CAMPANULATÆ.

GOODENIACEÆ.

631. *Velleia* panduriformis R. Cunn.
Stems several together, erect or ascending from a thickened woolly stock, 3-5ft. high; radical leaves 4-6in. long, broadly obovate, deeply toothed, stem-leaves or bracts broadly ovate or suborbicular, toothed, to 3in. diameter; calyx about ½in. long; sepals free almost to the base, the upper one broadly ovate, much longer than the others and prominently toothed, the others with ciliate entire margins all acute, green and glabrous without, shortly hirsute within; corolla dark-



...rnment Lithographer, Perth, W. A.

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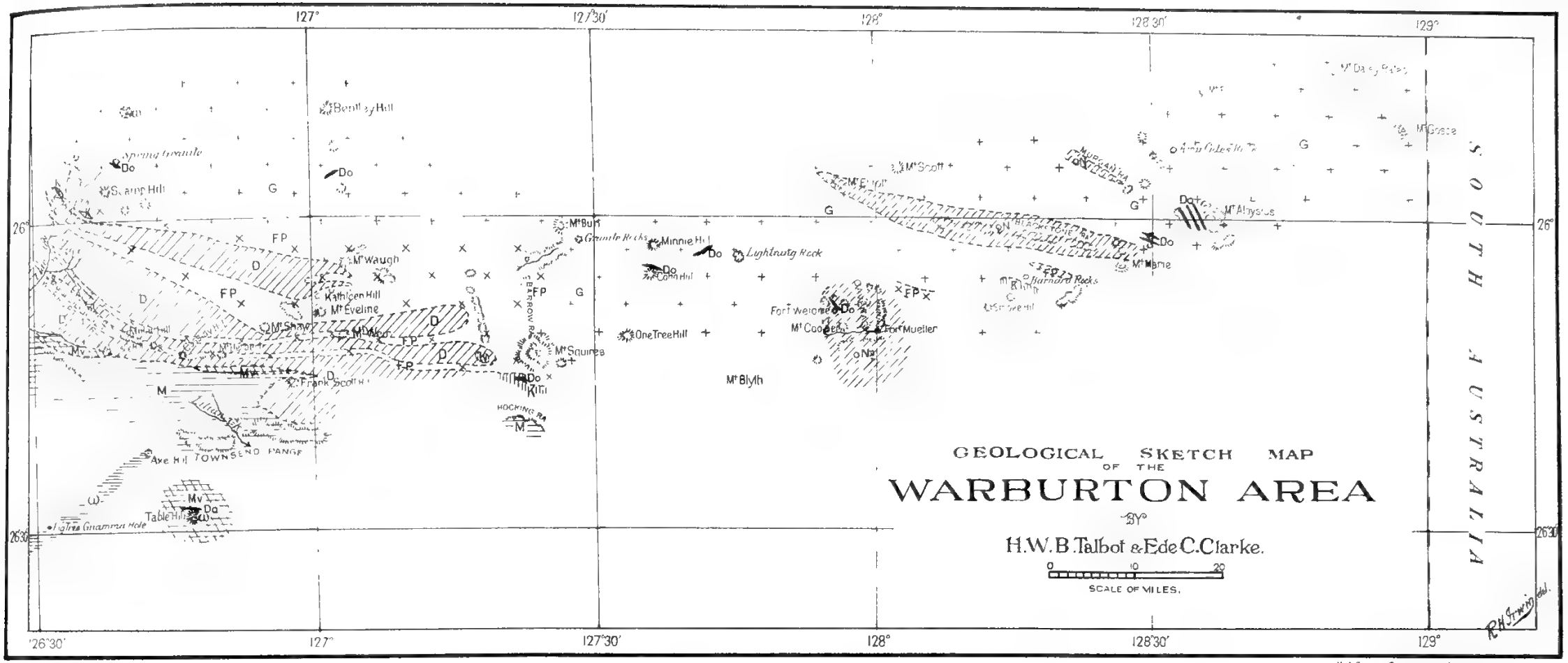
...stones, Claystones, Boulder Beds.

WILKINSON RANGE SERIES

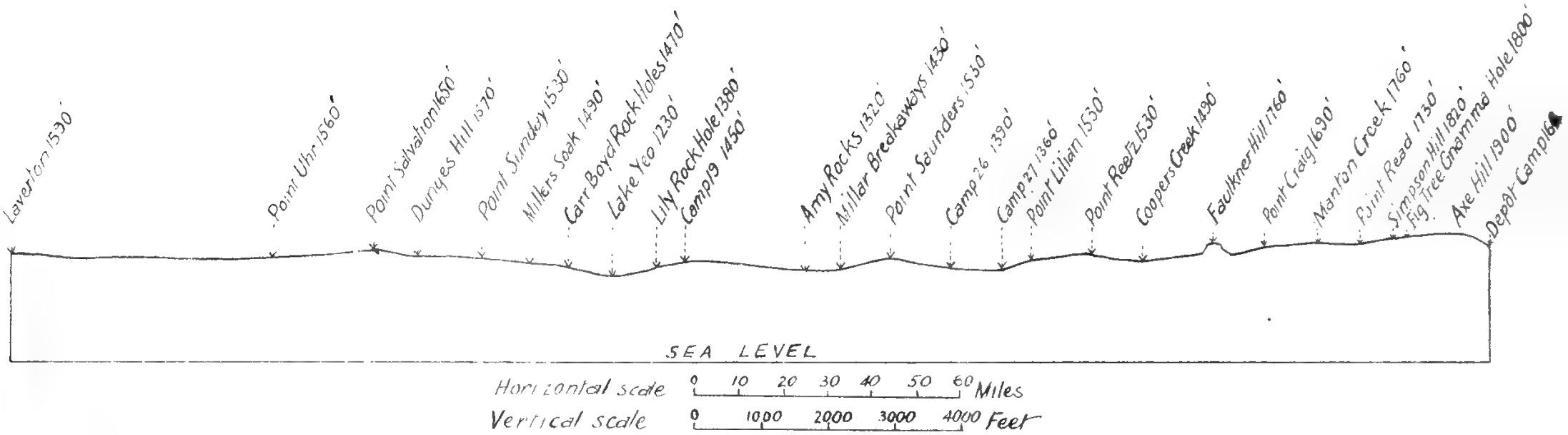
?LATE MESOZOIC
OR
TERTIARY

N


127°
127°30'
128°
128°30'
129°
26°
26°30'
SOUTH AUSTRALIA
Bentley Hill
Spring Granite
Swamp Hill
M^t Waugh
Kathleen Hill
M^t Eveline
M^t Shaw
Frank Scott
M^t Squires
M^t Blyth
M^t Burt
Granite Rocks
Minnie Hill
Lightning Rock
Coma Hill
One Tree Hill
Fort Welcome
M^t Cooper
Fort Mueller
Barnard Rocks
M^t Scott
M^t Aloysius
M^t Marie
M^t Daisy Peaks
M^t Grosse
Axe Hill
TOWNSEND RANGE
Table Hill
Lightning Gramma Hole
GEOLOGICAL SKETCH MAP
OF THE
WARBURTON AREA
BY
H.W.B. Talbot & Ede C. Clarke.
SCALE OF MILES.
R.H. Stuart del.
H.J. Pether, Government Lithographer Perth W.A.
Greenstone
BASIC IGNEOUS
Granite & Gneiss
ACID IGNEOUS
Porphyry
Grit, Agglomerate etc.
CLASTIC
Gabbro & Dolerite
BASIC IGNEOUS
METAMORPHOSED
NOT METAMORPHOSED
PRE — ORDOVICIAN
Conglomerate, Quartzite etc.
Basic Volcanic Rocks
TOWNSEND RANGE SERIES
ORDOVICIAN
Basalt Dolerite
BASIC IGNEOUS
POST ORDOVICIAN
Sandstones, Claystones, Boulder Beds.
WILKINSON RANGE SERIES
?LATE MESOZOIC
OR
TERTIARY

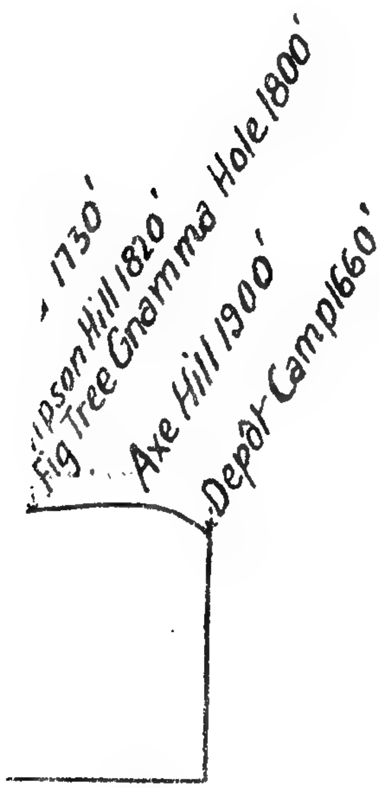
260/61

Fold Out



SECTION FROM LAVERTON TO DEPOT CAMP SHOWING SURFACE RELIEF

PLATE III.



yellow, nearly 1in. long, lower lobes narrowly winged, the upper ones shortly on the outer edge, the inner edge auriculated and almost completely enclosing the indusium there and in the throat slightly hirsute, otherwise glabrous, the saccate protuberance at the base short and thick; style stout, glabrous in the lower half, the upper half invested with fine hairs; indusium finely hirsute on both back and front, the margins ciliate.

632. *Goodenia* linifolia W.V.F., n. sp.

Stock woody, with numerous erect paniculately-branched stems which are always glandular and vary from glabrous to greyish-tomentose; leaves linear, entire, with involute margins so as to appear almost terete, without different basal leaves; peduncles in the upper axils, 1-flowered; ebracteate, orbiculate beneath the flowers; calyx very glandular-hirsute, the lobes lanceolate, longer than the tube; corolla glandular-hirsute without, the lobes conspicuously winged, the two upper ones deeply separated and prominently auriculate; style and indusium hirsute, the latter ciliate; capsule slightly viscid, ovoid, perfecting few seeds (4-6), the dissepiment short, often almost obsolete; seeds large, compressed brown, granulate, with broad yellowish membranous margins.

Near Derby; Inglis' Gap, King Leopold Ranges; Lennard, Isdell, Barnett Rivers (W.V.F.).

Height 9-18in. Leaves 1-2½in. long. Peduncles mostly ½-¾in. Corolla not exceeding ½in. long, yellow. Capsule under 3 lines long. In moist sandy soil.

Independently of other characters the foliage distinguishes this plant from other ebracteate species.

633. *G.* propinqua W.V.F., n. sp.

An erect annual, more or less invested with white usually spreading slightly glandular hairs, radical leaves, rosulate, broadly obovate, entire or slightly toothed, with white-woolly axils; stem-leaves few, linear, entire, longer than the radical ones, the floral leaves reduced to bracts; flowers small, in a loose raceme on much-branched panicle; pedicels filiform, bracteolate about half way up; calyx narrow, the lobes lanceolate, much shorter than the tube; corolla pubescent without, the upper lobes deeply divided, broadly winged on one side, slightly so on the other, lower lobes equally winged; ovary bilocular; ovules numerous, the dissepiment reaching almost to the summit; style and indusium scantily hirsute, the latter ciliate; capsule thin, narrow; seeds very small, orbicular, compressed, quite smooth, with minute membranous margins, often almost obsolete.

Inglis' Gap, King Leopold Ranges; base of Bold Bluff, Upper Isdell River (W.V.F.).

Height 1ft. or less. Leaves, radical, $\frac{1}{2}$in. or less long; stem $\frac{1}{2}$-1in. Pedicels $\frac{1}{2}$-$\frac{3}{4}$in. Calyx almost $1\frac{1}{2}$ line long. Corolla $4\frac{1}{2}$-5 lines long, upper lobes yellow to reddish-purple, lower yellow. Style and indusium reddish-purple. Capsules 2 lines long. Seeds shining-brown. In wet grassy spots.

Affinity to *G.* bicolor F. v M.

634. *G.* scaevolina F. v M.

Isdell and Lennard Rivers (W.V.F.).

Stems many, ascending, 2-3ft. high; flowers pale-blue. Sandy soil.

635. *G.* lamprosperma F. v M.

May, Meda, Lennard Rivers (W.V.F.).

Erect, often above 2ft. high, with numerous tufts of linear-lanceolate woolly-axilled leaves on the stems, branches and inflorescence. In damp sandy soil.

636. *G.* sepalosa F. v M.

Leaves often entire or scantily toothed.

Forms of this species occasionally merge towards *G.* auriculata Benth.

637. *G.* coronopifolia R. Br.

Cambridge Gulf (A. Cunn.) May, Meda, Lennard, Fitzroy, Isdell, Ord, and Denham Rivers (W.V.F.), Dillen's Springs (J. P. Rogers).

In moist grassy spots.

638. *G.* paniculata Smith.

Base of Bold Bluff (W.V.F.).

In wet grassy localities.

639. *Calogyne* Heppleana W.V.F., n. sp.

A procumbent or shortly ascending hispid or glandular pubescent annual; leaves shortly but distinctly petiolate, broadly obovate, entire or more often irregularly lobed or toothed, the floral ones similar but much reduced, the glandular pubescent pedicels much exceeding them; calyx-lobes narrow-lanceolate, obtuse, hardly as long as the tube; corolla glandular-hispid, the tube constricted above the ovary; upper lobes very deeply divided, unequally winged, each with a prominent reflexed auricle, the lower lobes equally winged; anthers conspicuously mucronate; ovary with few ovules in each cell, the dissepiment reaching to $\frac{1}{3}$ of its length; style hirsute, divided to above the middle into three

branches, the lateral ones slightly longer, much more slender than the central one; capsule narrow-ovate, usually ripening not more than 1-2 seeds in each cell; seeds narrow-ovate, flat, with thick edges, membrane-margined and densely muricate.

Isdell River, near Grace's Knob (W.V.F.).

Stems not exceeding 1ft. in length; leaves to above 1½in. long but usually less; calyx barely three lines long; corolla slightly above ½in. long, yellow streaked with reddish-purple; capsule nearly three lines long. Seeds brown.

In grassy spots. Named in honour of Mr. W. Hepple Brown, who was an officer of the Kimberley Survey Expedition, 1905.

Affinity to *C.* pilosa R. Br.

640. *Scaevola* revoluta R. Br.

Near Traine River; junction of Hann and Fitzroy Rivers (W.V.F.).

A spreading shrub. 3ft. high; leaves often above 1in. long, corolla over ½in. long, blue. In sandy loam.

641. *S.* scabrida W.V.F., n. sp.

Shrubby, with numerous erect much-branched stems from a thick stock, which along with the leaves are almost spinulose scabrous and densely grandular; leaves broadly sessile, oblanceolate to linear, obtuse, entire, with recurved margins; flowers in short dense terminal spikes; the lanceolate obtuse bracts almost as long as the flower; bracteoles similar, almost half as long as the flower, both bracts and bracteoles with dense tufts of white hairs in their axils; calyx-lobes exceedingly short and broad; corolla glandular without, lower half glabrous, upper portion spinulose scabrid, with the throat and tube densely invested with slightly reflexed white bristly hairs; anthers inappendiculate; ovary one-celled, two-ovulate; style and indusium scantily hairy, the latter slightly ciliate; fruit oblong, glabrous, tuberculate, one-seeded.

Summits of Mounts Herbert, Broome, and Rason; Packhouse and Isdell Ranges; Sunday Island (W.V.F.).

Height to 3ft.; leaves mostly ½-1½in. long. Corolla 4-5 lines long. White. Fruit about 1¾ lines long.

Among and in the crevices of sandstone and quartzite rocks.

Affinity to *S.* macrostachya Benth.

642. *S.* stenostachya W.V.F., n. sp.

A densely-branched depressed shrub, more or less hirsute; leaves broadly sessile, oblong to oblanceolate, obtuse, with recurved entire margins; flowers sessile, in long terminal

slender spikes; bracts ovate, acuminate, conspicuously ciliate, at least half as long as the flowers; bracteoles narrower but in other respects similar; calyx-lobes sinuate or almost obsolete; corolla densely pubescent without, the throat and tube within closely white bristly hairy; ovary one-celled, two-ovulate; style and indusium glabrous, the latter scantily ciliate; fruit oblong-ovate, tuberculate, one-seeded.

Near Isdell River, between Isdell Range and Grace's Knob (W.V.F.).

Plant 1ft. high, and at least once and a half as much across. Leaves 4-6 lines long. Corolla three lines long, white. Fruit about 1½ lines long.

Grows on grassy black soil plains.

Affinity to *S.* scabrida (W.V.F.).

643. *S.* decipiens W.V.F., n. sp.

A much-branched diffuse hispid perennial; leaves obovate to cuneate, conspicuously toothed, sessile or very shortly petiolate, the floral ones similar but smaller; flowers sessile, in short leafy spikes; bracteoles linear-lanceolate, at least one-third as long as the corolla; calyx-lobes small, broadly ovate; corolla pubescent without, within up to near the base of the lobes densely bristly hairy; anthers inappendiculate; ovary two-celled; style hairy; indusium with a dense tuft of long purplish hairs, on the base at the back longer than the indusium itself, the margins densely white ciliate; fruit ovoid-oblong, shortly hirsute and tuberculate.

Port Hedland (W.V.F.).

Height 4-6in. Leaves ¼-½in. rarely ¾in. long. Corolla about five lines long, whitish streaked with purple. Fruit two lines long. In sandy soil.

Affinity to *S.* humilis R. Br.

644. *Dampiera* conospermoides W.V.F., n. sp.

A spreading shrub, with stems, branches, underside of leaves and inflorescence densely white-stellate-tomentose; branches terete; leaves oblong to broad-lanceolate, obtuse tapering into the petioles, firm, entire, or the margins bordered by a few distant teeth, flat, at first stellate-tomentose above, becoming glabrous with age; flowers almost or quite sessile, 2-3 together, occasionally solitary, subtended by small ovate, obtuse bracts, on the long slender branches of a somewhat pyramidal panicle; bracteoles minute; calyx densely invested with white branched hairs, the lobes small and linear; corolla densely white tomentose without, the lower lobes linear-lanceolate, obtuse, pale-coloured, the upper ones ovate and shorter, the auricles comparatively large and of

a dark purple; ovary one-celled, with one erect oblong ovule laterally attached adjacent to the base; fruit ovate, smooth.

Dillen's Springs (W.V.F.).

Height 1-2ft. Leaves $\frac{3}{4}$-1$\frac{1}{2}$in. long. Calyx one line or less long. Corolla one line or less in length. Anthers yellow. Style and stigma purple. Fruit 1$\frac{1}{4}$-1$\frac{1}{2}$ line long. Among quartzite rocks.

Affinity to *D.* Linschotenii F. v M.

645. *Lobelia* dioica R. Br.

Isdell River, opposite Isdell Range; base of Artesian Range (W.V.F.).

Stems simple, erect or ascending; flowers blue. In moist black soil.

CANDOLLEACEÆ (STYLIDIACEÆ).

619. *Stylidium* Floodii F. v M.

Fortescue River (J. Forrest); Lennard and Isdell Rivers (W.V.F.).

In moist soil.

620. *S.* alsinoides R. Br.

Fortescue River (J. Forrest); Lennard, Barker, Richenda, Isdell, Ord, Denham, King Rivers; Mt. Eliza, near Lennard River. (W.V.F.).

Flowers pink. In damp soil.

621. *S.* cordifolium W.V.F., n. sp.

A flaccid ascending or straggling much-branched annual, glabrous or the inflorescence slightly glandular; the branches angled or winged; leaves cauline, alternate, broadly ovate or almost orbicular, sessile, cordate, or almost amplexicaul, mucronate, entire, becoming upwards small lanceolate acute bracts; flowers solitary, axillary and terminal on the branches, each branch forming a long slender spike; calyx-lobes linear-lanceolate, obtuse, the two lower ones connate to above the middle; corolla not much exceeding the calyx-lobes, the segments connate in pairs to above the middle; no appendages to the throat or labellum; capsule linear-fusiform, not beaked.

Isdell and King Rivers; Messmate Creek; between Isdell Range and Mt. Bartlett (W.V.F.).

Plant 1ft. or more in length. Leaves 3-4 lines long. Calyx 4-5 lines. Lobes 1-1$\frac{1}{2}$ line long. Corolla red and pink with a darker blotch at the base of the segments. Capsule at least $\frac{1}{2}$in. long.

In damp soil, occasionally associated with *S.* alsinoides R. Br. The foliage and corolla readily distinguishes this species from other members of the series Tenellae, section Nitrangium. Baron von Mueller received specimens from Mr. M. Holtze, of Port Darwin, during 1885 and 1890, and referred them to *S.* alsinoides R. Br. var. *cordifolium.*

Affinity to *S.* alsinoides R. Br.

622. *S.* rubriscapum W.V.F., n. sp.

An annual, glabrous excepting the flowers; stems sometimes shortly proliferous; leaves along with lower portion of the stem scattered, the upper ones collected in a dense whorl-like tuft, linear, ending in rather long acute points; scapes sub-terminal, filiform, red, with 1-2 awl-shaped bracts above the middle, one-flowered; calyx divided to the middle into five ovate-lanceolate, obtuse lobes, almost or quite glabrous; corolla glandular hairy, the tube rather short; lobes broad, entire; appendages small or none to the throat and absent from the small labellum; upper portion of the column invested with yellow glandular hairs; capsule glabrous, obovate, many-seeded.

Calder River; Messmate Creek in the Packhorse Range (W.V.F.).

Stems 1-2in. long. Leaves ¼-½in. long. Scapes 2-3in. high Calyx 2 lines long. Corolla about 3 lines long, yellow without, red within. Capsule about 2 lines long. In moist sandy soil.

Affinity to *S.* Floodii F. v. M.

623. *S.* leptorrhiza F. v M.

Prince Regent's River (A. Cunn.); Walcott Inlet; Calder, Charnley and Isdell Rivers (W.V.F.).

Flowers red. In damp spots.

624. *S.* muscicola F. v M.

Sprigg River (W.V.F.).

Flowers pink. On wet cliffs.

625. *S.* pachyrrhizum F. v M.

Isdell, Charnley, Calder and Sprigg Rivers (W.V.F.).

Total height of plant to 1½ft.; leaves spathulate, 2-3in. long, tapering into the petioles; corolla-lobes unequal, yellow without, red within. In moist soil.

626. *S.* lobuliflorum F. v M.

Isdell, Hann, Adcock and Charnley Rivers (W.V.F.).

Flowers pink. In wet sandy spots.

627. *S.* rotundifolium R. Br.

Isdell River, near Mt. Bartlett (W.V.F.).

Leaves sometimes spathulate, to ¾in. long, including the petioles; flowers pink with red blotches at the base of the segments; capsule 1-1½in. long. In rocky spots.

628. *S.* irriguum W.V.F., n. sp.

A slender erect annual, bearing a slight glandular pubescence on the flowers, otherwise glabrous; leaves radical, closely approximated but not rosulate, spathulate, tapering into a long petiole; scapes filiform, solitary or 2-3 from the one stock, the flower at first solitary and shortly pediculate above a bract; ultimately a branch or bracteolate pedicel grows out from the axil of the bract and leaves usually a second flower; occasionally the scape bears 3-5 sessile flowers; calyx-lobes connate into two almost orbicular entire lips; corolla exceeding the calyx, the two larger lobes somewhat connate, without appendages; capsule very slender.

Messmate Creek, in the Packhorse Range; Isdell and Charnley Rivers (W.V.F.).

Total height of plant 2-3in. Leaves, laminae, 2-3 lines; petioles ½-¾in. long. Calyx-lobes ¾ line long. Corolla pale-yellow or white, scarcely 2 lines long. Capsule to nearly ¾-in. long. In moist sandy soil.

Affinity to *S.* rotundifolium R. Br.

629. *S.* fissilobum F. v M.

Hann, Adcock, Barnett and Isdell Rivers (W.V.F.).

Flowers red. In wet soil.

630. *S.* claytonioides W.V.F., n. sp.

An annual, glabrous excepting the calyx-lobes, the whole plant of a reddish hue; stems with alternate subulate almost bract-like leaves, and surmounted by a tuft of terete obtuse, succulent leaves; scapes erect, filiform, from few to many together, bracteate, each bearing a solitary sessile flower; calyx-tube long and slender, when in flower appearing as a prolongation of the scape and scarcely distinguishable from it, the lobes connate into broadly spathulate or almost orbicular entire glandular-ciliate lips; corolla-lobes equal, entire, about as long as the tube; no appendages to the throat or to the small concave obtuse labellum; column broad and flat; anthers comparatively large; capsule narrow-linear, slightly beaked, the valves on dehiscing surmounted by the persistent calyx-lobes.

Between Isdell Range and Mt. Bartlett (W.V.F.).

Stems ½-1½in. high. Leaves under 1in. long, sometimes green. Scapes 3-5in. high. Calyx-lobes scarcely 1 line long. Corolla 3 lines long, bright-red. Column to ⅓in. long. Capsule 1-1½in. long.

In moist grassy spots. This species differs from all other simple flowered ones of the Series Corymbulosae, in foliage, calyx and capsule.

COMPOSITÆ.

646. *Pleurocarpaea* denticulata Benth.
Kimberley districts (Dr. House).
Specimens unsatisfactory.

647. *Vernonia* cinerea Lessing.
Roebuck Bay (J. W. O. Tepper), Lennard, Fitzroy, Hann, and Isdell Rivers (W.V.F.).
Erect, few-branched, 1-2ft.; florets pale or purple. Sandy loam.

648. *Olearia* aspera W.V.F., n. sp.
Stems several, few to many branched, erect or ascending from a thick woody stock and along with the foliage rough from numerous short septate asperities; leaves hardly spreading, frequently appressed, linear or a few of the lower ones oblanceolate, usually mucronate, sessile, rigid, margins entire, revolute, the midrib conspicuous, gradually reduced upwards until they become small and bract-like at the base of the involucres; flower-buds terminating the branches and not distinctly pedunculate; involucre hemispherical, the bracts narrowly lanceolate, acute, ciliate, the inner ones gradually shorter; ray-florets about 15; disk florets numerous and but slightly exceeding the involucre; style-appendages short, stout and obtuse; achenes silky-pubescent, those of the ray broad, much compressed, with thickened margins and usually a prominent rib on the inner face, those of the disk narrow terete, shortly stalked and apparently abortive; pappus-bristles of the ray-florets very numerous with a few shorter outer ones, of the disk florets similar but fewer, all scabrous.
Packhorse and Edkins Ranges; between Isdell and Precipice Ranges; Mounts Brennan and Rason, Isdell River; Dillen's Springs (W.V.F.).
Stems to 2ft. in height but oftener much less. Leaves ½-¾in. long. Involucres at least ½in. diam. Ray florets blue or purplish.
In sandy soil. The species very closely approaches *Vittadinia*. Affinity to *O. ciliata* F. v M.

649. *Vittadinia* brachycomoides F. v M,
Summit of Mount Broome (W.V.F.).
In sandy soil.

650. *V.* scabra DC.

Summit of Mount Rason, Artesian and Edkins Ranges (W.V.F.).

A narrow-leaved form. In sandy soil.

651. *Blumea* pungens W.V.F., n. sp.

An erect rigidly-branched plant, the branches and foliage hirsute and very viscid; leaves rigid, lanceolate, pungent-pointed, broadly sessile, prominently veined beneath, the margins with distant pungent teeth; flower heads hemispherical, terminating bracteate peduncles and forming a large pyramidal panicle; involucral bracts numerous, linear, obtuse or subacute, glandular and often ciliate, the outer ones gradually shorter, numerous in several rows and frequently squarrose; outer filiform florets very numerous and longer than the style, the inner mostly few, five rarely four-lobed, with a 2-3 branched style; achenes terete, striate, silky-hairy.

Vicinity of the Barker River (W.V.F.).

Height 2-3ft. Leaves 1-2in. long. Flower-heads four lines long. Florets yellow. On granite hills.

Affinity, readily distinguished from other species by the foliage.

652. *B.* Wightiana DC.

Isdell River (W.V.F.).

An erect strongly scented plant of 2-3ft.; florets purple. In black and sandy loam.

Specimens of this plant were referred by Bentham in the Flora Australiensis to *B. lacera* DC., a species at present not found in Australia.

653. *B.* integrifolia DC.

Isdell, Ord, Denham, and King Rivers (W.V.F.).

Florets four-merous, yellow. Sandy loam.

654. *B.* Cunninghamii DC.

Careening and Vansittart Bays (A. Cunn.) Ord and Isdell Rivers; Dillen's Springs (W.V.F.)

Florets purple. In sandy and stony spots.

655. *B.* laciniata DC.

Isdell, Lennard, Hann, and Denham Rivers (W.V.F.).

Erect, 2ft.; florets yellow. In sandy loam.

656. *B.* prostrata W.V.F., n. sp.

A perennial with a thick woody stock, the stems numerous, prostrate and often rooting at the nodes, along with the foliage and peduncles more or less pubescent and sometimes woolly in the leaf-axils; leaves ovate, obtuse, broadly sessile or semi-amplexicaul, margined with distant callous teeth;

flower-heads few, almost hemispherical on slender terminal peduncles; involucral bracts linear, acute, the outer series not numerous, ciliate; filiform florets longer than the styles, about equal in number to the disk florets; disk florets five-toothed. the style branches rather short; achenes scantily silky-hairy. compressed.

Isdell River (W.V.F.)

Stems to 3ft. long. Leaves under 1in. long. Flower-heads 3-3½ lines long. Florets yellow. In moist sandy loam.

657. *Pluchea* tetranthera F. v M.

Diffuse and much branched. 2-3ft. high. glandular and glabrous or slightly tomentose; florets white or reddish purple. This species has the appearance of *Eremophila* latifolia F. v M.

Var. cinerea (W.V.F.), n. var.

Isdell River (W.V.F.).

A hoary-tomentose bushy shrub of 3ft. in height; involucres ovoid. viscid-tomentose; outer short bracts broadly ovate. the inner narrower and longer; florets purple. with few or no filiform ones. In sandy soil.

Var. tomentosa F. v M.

Cane, Fortescue, and Ashburton Rivers (J. & A. Forrest), Lennard and Isdell Rivers (W.V.F.).

Bushy, 2ft. high; florets reddish.

658. *P.* odorus Benth.

Ord River (Alex. Forrest); near Derby, Goody Goody, Meda. and Lennard Rivers, Sunday Island (W.V.F.).

Of shrubby habit and much branched, reaching a height of 3ft.; florets reddish-purple.

659. *P.* macrocephalus Benth.

Roebuck Bay (J. W. O. Tepper) Nine Mile Range, from Wyndham; Ord River (W.V.F.).

A perennial of 2-3ft. in height; ray-florets pale-coloured. In sandy soil.

660. *P.* adscendens Benth.

Cygnet Bay (W.V.F.).

Florets white. On damp saline flats.

661. *Epaltes* australis Lessing.

Isdell, Barnett, and Charnley Rivers (W.V.F.).

A *Myriogyne*-like plant with greenish-yellow flowers.

662. *Sphaeranthus* indicus L.

King Sound district (Froggatt), Fitzroy, Lennard, Barker, Isdell, Adcock, Barnett, Hann, Charnley, and Calder Rivers; bases of Mounts House, Clifton, and Hamilton (W.V.F.).

Erect, strongly scented, 9-12in. high; florets purple. In damp spots. This includes the *G. hirtus* Willd. of the Flora Australiensis.

663. *S.* africanus L.
North-West Coast (A. Cunn.) Calder River and Walcott Inlet (W.V.F.).
In damp soil. Includes the *G. microcephalus* of the Flora Australiensis.

664. *Spilanthes* grandiflorum Turcz.
Isdell River (W.V.F.).
On grassy black soil plains.

665. *Pterocaulon* sphacelatus Benth. et Hook.
Erect, or scantily branched, 1-3ft. high; florets white to purple.

666. *P.* verbascifolius Benth. et Hook.
Glenelg River (J. Martin) Lennard River; near Inglis' Gap, King Leopold Ranges (W.V.F.).
Erect, 2ft.; florets purple. In sandy soil overlying granite rocks.

667. *P.* glandulosus Benth. et Hook.
Yule River (J. Forrest) Adcock River; bases of Mounts Herbert, House, and Clifton (W.V.F.).
Stems erect, about 2ft.; branching, several from the same stock; clusters of flower-heads sometimes 2in. long, always viscid; florets white. In sandy soil.

668. P. *globuliforus* W.V.F., n. sp.
A much spreading shrub, with the branches closely white-tomentose; leaves ovate, obtuse, of thin texture, margined with distant small teeth, green and finely tomentose above, densely white-tomentose beneath, each contracted into a short petiole and long decurrent in narrow entire wings; clusters of flower-heads globose, distant, leaf-opposed or axillary and closely sessile; bracts of the common receptacle short, linear to linear-spathulate, densely woolly-tomentose, those of the partial involucures linear to linear-lanceolate, acute, scarious, about twice as long as those of the receptacle; ray-florets 12-15; disk-florets solitary; style-lobes subulate; pappus bristles scabrous; achenes slightly compressed, finely silky-hairy.
Wingrah Pass, Napier Range (W.V.F.).
Height 2ft. Leaves mostly 1-1½in. long. Clusters of flower-heads 4-5 lines diameter. Florets white. Among limestone rocks.
Affinity to *P. sphacelatus* Benth. et Hook.

669. *Gnaphalium* indicum L.
King Sound (Froggatt), near Derby (W.V.F.).
In saline spots.

670. *Helichrysum* apiculatum DC.
A narrow-leaved form along the Isdell River, near Grace's Knob, and also near the Charnley River, North-West Australia.

671. *Eriochlamys* knappii F. v M.
Fortescue, Lyons, and Upper Ashburton Rivers (H. S. King); Mount Magnet and Cue (W.V.F.); Cue (C. Andrews).
In ferruginous sandy loams.

672. *Siegesbeckia* orientalis L.
Lennard and Isdell Rivers (W.V.F.).
In sandy loams.

673. *Wedelia* asperrima Benth.
King Sound district (Froggatt), Lennard and Isdell Rivers (W.V.F.).
Erect, 1-2ft.; florets yellow. In sandy loams.

674. *Bidens* pilosus L.
Meda, May, Lennard, Barker, Richenda, Fitzroy, Adcock, Hann, Barnett, Isdell, Charnley, and Calder Rivers; Bell, Station, Manning, and Synnott Creeks (W.V.F.).
Often 4ft. high; ray-florets none. A pest in North-West Australia. Grows in good soil.

675. *B.* bipinnatus L.
Isdell River (W.V.F.).
Florets yellow. In sandy loam.

676. *Glossogyne* filifolia F. v M.
Near Inglis' Gap, King Leopold Ranges; Lennard River (W.V.F.).
Erect, much-branched, 2-3ft. high; florets white. Among schistose rocks.

INDEX.

INDEX—*continued.*

INDEX—*continued.*

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